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VEGETATION OF THE WELLS GRAY STUDY AREA

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MOE Technical Report 21

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TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS	iii
TABLE OF CONTENTS	v
LIST OF FIGURES	ix
LIST OF PLATES	xi
CHAPTER ONE INTRODUCTION	1
1.1 Objectives	1
1.2 Physiography of the Study Area	1
1.3 Sampling and Data Used	3
1.4 Classification and Descriptions	4
1.4.1 Vegetation Zonation	4
1.4.2 Vegetation Landscapes	4
1.5 Products	5
CHAPTER TWO VEGETATION	6
2.1 ICHe - Cool, Semi-Moist, Central Interior Cedar - Hemlock Subzone	6
CD Black Cottonwood - red-osier dogwood	11
DA Douglas-fir - aster	12
DJ Douglas-fir - juniper	14
RB Western red cedar - Oregon boxwood	15
RD Western red cedar - devil's-club	17
2.2 ICHm - Moist, Central Interior Cedar - Hemlock Subzone	18
AK Trembling aspen - kinnikinnick	24
BB Paper birch - Oregon boxwood	26
BD Paper birch - red-osier dogwood	29
BF Paper birch - filbert	30
CD Black cottonwood - red-osier dogwood	32
DC Douglas-fir - ceanothus	33
DS Douglas-fir - saskatoon	34
HB Western hemlock - Oregon boxwood	36
PB Lodgepole pine - Oregon boxwood	37
RD Western red cedar - devil's-club	38

TABLE OF CONTENTS (CONTINUED)

		Page
RS	Western red cedar - skunk cabbage	39
WB	Wetland bog	40
WF	Wetland fen	41
WS	Wetland swamp	42
2.3	ICHw - Wet, Central Interior Cedar - Hemlock Subzone	43
AS	Sitka mountain alder - spiny shield fern	46
CD	Black cottonwood - red-osier dogwood	47
DB	Douglas-fir - blueberry	49
HO	Western hemlock - oak fern	50
RD	Western red cedar - devil's-club	51
RS	Western red cedar - skunk cabbage	53
WB	Wetland bog	54
WF	Wetland fen	55
2.4	ICHv Wet, Central, Montane Interior Cedar - Hemlock Subzone	56
AS	Sitka mountain alder - spiny shield fern	57
RD	Western red cedar - devil's-club	58
2.5	ESSFm - Moist, Central Engelmann Spruce - Subalpine Fir Subzone	59
AS	Sitka mountain alder - spiny shield fern	61
FB	Alpine fir - black blueberry	62
FD	Alpine fir - devil's-club	63
FR	Alpine fir - white-flowered rhododendron	64
FT	Alpine fir - simple-stemmed twistedstalk	66
WF	Wetland fen	67
2.6	ESSFu - Wet, Central, Upper Engelmann Spruce - Subalpine Fir Subzone	68
AS	Sitka mountain alder - spiny shield fern	70
FA	Alpine fir - broad-leaved arnica	71
FV	Alpine fir - Sitka valerian	72
2.7	ESSFp - Engelmann Spruce - Subalpine Fir, Parkland Subzone	74
BP	Dwarf blueberry - woolly pussytoes	75
FL	Alpine fir - luetkea	76

TABLE OF CONTENTS (CONTINUED)

		Page
GS	Yellow glacier lily - western spring beauty	77
	SM Sedge - moss	79
	SP Sedge - peat moss	80
	VF Sitka valerian - subalpine fleabane	81
2.8	ATe - Moist, Alpine Tundra Subzone	82
	FC - Alpine fir - Merten's cassiope	83
	GS - Yellow glacier lily - western spring beauty	85
	SW - Sedge - wood-rush	86
REFERENCES		87
APPENDIX A	PLANT SPECIES LIST	90
APPENDIX B	POTENTIAL AVAILABILITY OF KEY WINTER FORAGE SPECIES AFTER CLEARING AND FIRE, FOR VEGETATION LANDSCAPES WITHIN THE ICHe and ICHm SUBZONES	95

LIST OF FIGURES

Figure		Page
1.1	Study Area	2
2.1	The relationship of vegetation landscapes for the ICHe	10
2.2	The relationship of vegetation landscapes for the ICHm	23

LIST OF PLATES

Plate		Page
2.1	Mature vegetation of the Douglas-fir - aster vegetation landscape (DA)	13
2.2	Mature vegetation of the Douglas-fir - juniper vegetation landscape (DJ)	13
2.3	Young forested vegetation of the Western red cedar - Oregon boxwood vegetation landscape (RB)	16
2.4	Disturbance vegetation of the Trembling aspen - kinnikinnick vegetation landscape (AK)	25
2.5	Three successional stages of the Paper birch - Oregon boxwood vegetation landscape (BB)	27
2.6	Young forested vegetation of the Paper birch - filbert vegetation landscape (BF)	31
2.7	Young, open forested vegetation of the Douglas-fir - ceanothus vegetation landscape (DC)	31
2.8	Recent disturbance vegetation of the Douglas-fir - saskatoon vegetation landscape (DS)	35
2.9	Recent disturbance vegetation of the Black cottonwood - red-osier dogwood vegetation landscape (CD)	48
2.10	Typical, mature vegetation of the Western hemlock - oak fern vegetation landscape (HO)	48
2.11	Typical, mature vegetation of the Western red cedar - devil's-club vegetation landscape (RD)	52
2.12	Mature vegetation of the Alpine fir - white-flowered rhododendron vegetation landscape (FR)	65
2.13	Mature vegetation of the Alpine fir - Sitka valerian vegetation landscape (FV)	73
2.14	Mature vegetation of the Alpine fir - luetkea vegetation landscape (FL)	78
2.15	Vegetation of the Yellow glacier lily - western spring beauty vegetation landscape (GS)	78
2.16	Vegetation of the Alpine fir - Merten's cassiope vegetation landscape (FC)	84
2.17	Vegetation of the Sedge - wood-rush vegetation landscape (SW)	84

CHAPTER ONE
INTRODUCTION

The vegetation of Wells Gray Park and two small extension areas (Figure 1.1) was studied in the summer and early fall of 1984, in conjunction with terrain, soils and animal habitat. The study was initiated by the Parks and Outdoor Recreation Division of the British Columbia Ministry of Lands, Parks and Housing to assess the present and potential habitat available for moose, mule deer, woodland caribou, mountain goat and grizzly bear. Previously, vegetation of Wells Gray Park was described by Hamet-Ahti (1965).

Plant names throughout the report follow Taylor and MacBryde (1977). A species list is presented in Appendix A, for names used in this report.

1.1 OBJECTIVES

The main objectives of the vegetation study are:

1) to broadly describe the vegetation of Wells Gray Park
2) to provide a broad understanding of potential vegetation communities and their relationship to the various plant habitats present in the park; that is, to describe vegetation communities possible following disturbance and through succession to a mature state, on various sites
3) to provide information on potential winter forage for ungulates and what management is required for best production of forage and cover.

1.2 PHYSIOGRAPHY OF THE STUDY AREA

Wells Gray Provincial Park occurs in south-central British Columbia (Figure 1.1). Three physiographic units occur within the park, including, the Shuswap Highland, the Quesnel Highland and the Cariboo Mountains (Holland, 1976). The Shuswap Highland, which extends southward from Mahood Lake and Murtle Lake, consists of gentle or moderate sloping plateau areas rising from 1500 m to 2100 m and is dissected by rivers such as the Clearwater while the valley has steep sides (Holland, 1976). Within the study area, the highest point in the Shuswap Highland is Trophy Mountain at 2577 m.

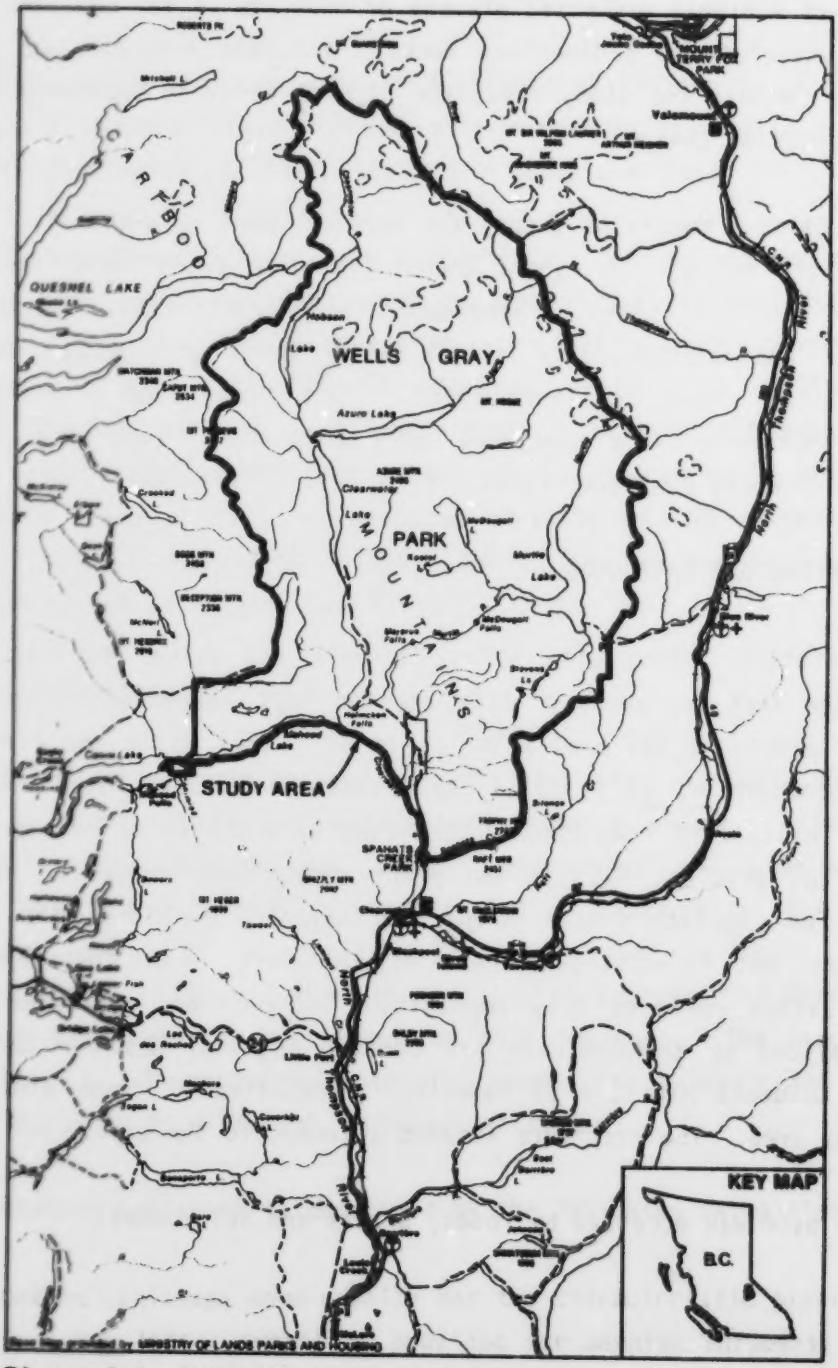

Figure 1.1 Study Area.

The Quesnel Highland, which extends westward from Clearwater Lake and Hobson Lake, and northward from Mahood Lake, has upland areas which are remnants of a highly dissected plateau of moderate relief (Holland, 1976). The area is underlain by sedimentary rocks. Volcanic features are common within the park. Within the study area, the highest point in the Quesnel Highland is Mount Perseus at 2541 m.

The Cariboo Mountains occupy the northern part of the park. They comprise a number of longitudinal ranges trending northwestward, which have many steep peaks and sawtooth ridges. These mountains characteristically combine gentler southerly and southwesterly slopes with steep and abrupt northerly and northeasterly slopes (Holland, 1976). Peaks over 2500 m are common. The Cariboo Mountains are composed of sedimentary rock and metamorphosed sedimentary rocks (Holland, 1976).

1.3 SAMPLING AND DATA USED

Vegetation, along with soils, terrain and animal habitat, was sampled during the last two weeks of July and the last two weeks of September, 1984. Sampling procedure followed Walmsley *et al* (1980) while the field forms used follow Sondheim *et al* (1983). Approximately 85 site, soil, vegetation and wildlife plots were completed. The sites were chosen to be representative of the various physical habitat and plant communities present. Because of the emphasis on ungulate winter range, the majority of plots were done at lower elevations and in southern areas of the park. The resulting vegetation classification reflects this emphasis. In addition, approximately 90 plots were provided by the Kamloops and Cariboo Regional Research Sections of the British Columbia Ministry of Forests. Fifty-five of these plots were within the study area. The rest were located adjacent to the park.

The park was accessed by roads, trails and helicopter.

1.4 CLASSIFICATION AND DESCRIPTIONS

1.4.1 Vegetation Zonation

The Biogeoclimatic Zonation System, developed by Krajina (1965,1969) and modified by the British Columbia Ministry of Forests (Pojar, 1983), is used as a framework for discussion of vegetation within Wells Gray Park.

Biogeoclimatic Zones, Subzones and Variants have been mapped and described for Wells Gray Park and surrounding areas by the British Columbia Ministry of Forests (Lloyd, 1984). For the current study, the park has been remapped using a modification of the Biogeoclimatic Subzone level (Lea, 1985a). A Biogeoclimatic Subzone is the area over which a distinct climatic climax community or zonal ecosystem association occurs, as influenced by one type of regional climate (Lloyd, 1984). A subzone consists of unique sequences of geographically related ecosystems (Lloyd, 1984). Biogeoclimatic Subzones in the park are described in Chapter Two.

1.4.2 Vegetation Landscapes

Vegetation Landscapes are defined as areas that are relatively homogenous with regards to soils, surficial material, disturbance history, climate, and trends of secondary succession (Lea, 1985b). Vegetation Landscapes are plant habitats that have the potential to support similar communities of vegetation through various stages of succession. For this study a broad level of Vegetation Landscapes is described by Biogeoclimatic Subzones, in Chapter Two. Some Vegetation Landscapes occur in two or more subzones. The descriptions give the ability to determine the potential vegetation a particular area of landscape may support, at different successional stages.

Each Vegetation Landscape is described by the following categories:

Name: A Vegetation Landscape name usually has two characteristic plants in its title. A two letter symbol is provided for mapping purposes. To the right of the name, a Biogeoclimatic subzone symbol is given, to indicate which subzone the vegetation landscape is found in.

Description: This is an environmental description pertaining to soils, terrain, topography and topoclimate.

Successional Trends (or Vegetation): Vegetation commonly associated with each Vegetation Landscape is described. Dominants are those species that are usually present and abundant. Associates are those species usually present and of limited abundance or those species sometimes present and abundant when present. Three successional stages are given for forested Vegetation Landscapes. The After Disturbance stage occurs until tree species dominate a site. Young forests are up to approximately 80 years in age. Mature forests are greater than 80 years.

Winter Forage Potential for Wild Ungulates: Those plant species used as winter forage are listed as Abundant (more than twenty percent cover) and Moderate (between five and twenty percent cover). Winter forage species were determined from information from Stewart (personal communication[1]), Blower (In preparation), Ahti (1962), Edwards and Ritcey (1960), Edwards et al., (1960), Ritcey (1961) and Ritcey (1962). Deep snow may prevent forage from being available on many of the Vegetation Landscapes. Arboreal lichens are rated for abundance as relative to the study area.

Comments: Information regarding ecology, manipulation, sensitivities and anomalies are described here. Rate of succession is described as being relative to a subzone. Within the Interior Cedar-Hemlock Zone a moderate rate of succession means that a closed forest stand will exist within approximately 20 years after disturbance.

1.5 PRODUCTS

Besides this report and a Biogeoclimatic Subzone map, a Broad Vegetation Cover Type map is available for the study area (Lea, 1985c).

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[1]Stewart, A. C. Personal communication, 1984. Wildlife Branch, British Columbia Ministry of Environment, Victoria, British Columbia.

CHAPTER TWO
VEGETATION

Within Wells Gray Park, coniferous forests predominate. Mixed coniferous and broad-leaved forests occur in southern areas, and an alpine zone occurs at higher elevations. Three Biogeoclimatic Zones occur in the park, the Interior Cedar-Hemlock Zone, the Engelmann Spruce-Subalpine Fir Zone, and the Alpine Tundra Zone (Lloyd, 1984).

The Interior Cedar-Hemlock Biogeoclimatic Zone (ICH), which corresponds to the Columbia Forest Region of Rowe (1972), has forests dominated by closed stands of western hemlock, western red cedar, Douglas-fir and paper birch. This Zone is represented by four subzones within the park. The Engelmann Spruce-Subalpine Fir Biogeoclimatic Zone (ESSF), which corresponds to the Subalpine Forest Region of Rowe (1972), has forests dominated by alpine fir and Engelmann Spruce. This Zone is represented by three subzones within the park. The Alpine Tundra Biogeoclimatic Zone (AT) is composed of meadows, tundra, heath and sparsely vegetated rock areas. It is represented by one subzone within the park.

2.1 ICHe - COOL SEMI-MOIST CENTRAL INTERIOR CEDAR - HEMLOCK SUBZONE

This subzone is found at lower elevations in the southwestern portion of the park, north and west of Mahood Lake. It is limited in areal extent in the park.

Environment

This subzone is subjected to moderate precipitation. It generally has the lowest precipitation and snowfall of any area in the park, although southern areas of the Moist, Central Interior Cedar-Hemlock Subzone (ICHm) receive similar precipitation.

Soils are moderately leached. Dystric Brunisols occur on moderately coarse to coarse-textured soils. Luvisols occur on finer textured soils. Litter layers are moderately well developed.

Vegetation

Sites with average moisture availability, within this subzone have mature communities dominated by closed forests of western red cedar with an abundant moss understory and a sparse cover of Oregon boxwood, black blueberry, Canadian bunchberry and blue- bead clintonia. Alpine fir and hybrid spruce may be present in low amounts, particularly in areas with cold air drainage. In some very dense stands of western red cedar litter inhibits all understory growth. After disturbance average sites commonly have a dense shrub dominated cover of thimbleberry, willows, Oregon boxwood, black blueberry and fireweed. Revegetation following disturbance is rapid. Seral forests commonly have Douglas-fir and paper birch, often with lodgepole pine and spruce, and an understory of Oregon boxwood, wild sarsaparilla, northern twinflower, Canadian bunchberry and a moderate moss cover.

Drier sites within this subzone, particularly on steep southern exposures, have mature forests dominated by open to closed stands of Douglas-fir with an understory of junipers, birch-leaved spirea, common snowberry, showy aster, kinnikinnick and pine grass. After disturbance, seral communities have shrub/ herb dominated communities of saskatoon, Rocky Mountain maple, common juniper, aster, pine grass and bluebunch wheat grass. These sites are slow to succeed to seral forests. Seral forests are intermediate to mature and early seral communities.

Wetter sites within this subzone, which are associated with seepage in lower slope positions, have mature and seral forests dominated by western red cedar, devil's-club, lady fern, oak fern and spiny shield fern. Lesser amounts of spruce and alpine fir may occur. After disturbance a dense shrub-dominated vegetation of alder, thimbleberry and devil's-club may develop.

Floodplain areas commonly have mature and seral forests of black cottonwood, red-osier dogwood, willows, bristly Nootka rose and horsetails. After disturbance common plants include willows, thin-leaved mountain alder and red-osier dogwood.

Forage Potential

Winter Forage production for ungulates in this subzone is best after removal of tree cover. On average sites, the potential diversity and production of forage species is high after disturbance. Common forage species include Scouler's willow, Oregon boxwood, paper birch, Douglas-fir and black blueberry, and lesser amounts of Rocky Mountain maple, saskatoon, red-osier dogwood, twinberry honeysuckle, Oregon-grape, trembling aspen, alpine fir, mountain-ash, and western yew. Most of these species increase after clearing or fire. Scouler's willow responds particularly well to fires (Mueggler, 1965). After a repeated disturbance species such as willow, paper birch, Rocky Mountain maple and red-osier dogwood resprout quickly from their bases and stems. Mature forests have low forage production, however they have good snow interception, therefore they are more useable by ungulates in deep snow. Mature forests have moderate arboreal lichen production.

On drier sites, particularly on southern exposures, forage potential is moderate. Common forage species include bluebunch wheat grass, saskatoon, redstem ceanothus and Douglas-fir with lesser amounts of Oregon boxwood, Rocky Mountain maple, Oregon-grape, paper birch, trembling aspen, common snowberry, roses, wild cherries, willows, kinnikinnick and shrubby penstemon. Snowbush ceanothus, although not seen in this subzone in the park, is believed to have potential to grow on these drier sites. Both snowbush ceanothus and redstem ceanothus require fire for their seeds to germinate (Gratkowski, 1973). They both resprout well after disturbance but are intolerant of shade. Most of the other species respond well to opening of the forest canopy by clearing or fire. They have a low cover in denser forested stages. Mature Douglas-fir have a significant amount of branch breakage in winter months which provides forage underneath stands. Douglas-fir provides a significant proportion of winter forage for mule deer in some parts of the province (Armleder, personal communication[1]). Mature Douglas-fir trees are efficient at intercepting snow.

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[1]Armleder, H. Personal Communication. 1983. Research Branch, British Columbia Ministry of Forests, Williams Lake, British Columbia.

Wetter sites, which have devil's-club, have low forage potential. Species include blueberries, alpine fir and mountain-ash.

Floodplain areas, although limited in extent, have abundant forage potential through all stages of succession. Common species include red-osier dogwood, willows, roses, common snowberry and twinberry honeysuckle. Black cottonwood is available and abundant after disturbance.

The following five Vegetation Landscapes have been recognized within this subzone. Figure 2.1 depicts the positional relationship of these vegetation landscapes to each other.

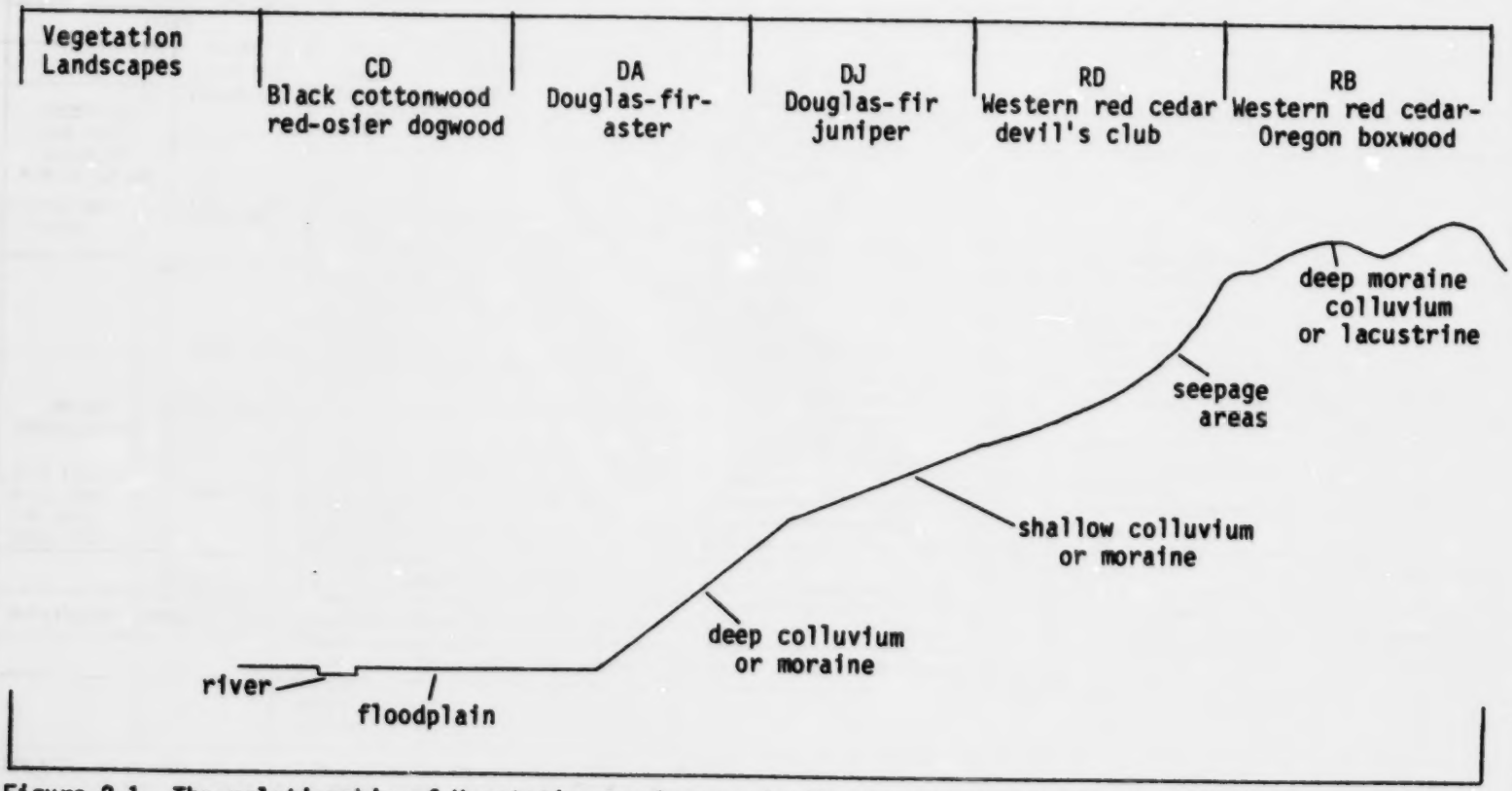

Figure 2.1 The relationship of Vegetation Landscapes in the terrain for the Cool, Semi-Moist, Central, Interior Cedar-Hemlock Subzone (ICHe) (for descriptions of the vegetation landscapes, see the text).

CD Black cottonwood - red-osier dogwood vegetation landscape				ICHe
Description: found on level floodplain areas subject to yearly inundation; soils are poorly drained and subject to deposition of new materials				
		AFTER DISTURBANCE	YOUNG FORESTS	MATURE FORESTS
SUCCESSIONAL TRENDS	DOMINANTS	shrub dominated vegetation of: willows thin-leaved mountain alder black cottonwood red-osier dogwood	dense broad-leaved forests of: black cottonwood red-osier dogwood willows bristly Nootka rose horsetails	dense broad-leaved forests of: black cottonwood red-osier dogwood willows bristly Nootka rose horsetails
	ASSOCIATES	rose twinberry honeysuckle horsetails sedges common pink pyrola Lindley's aster	thin-leaved mountain alder twinberry honeysuckle common snowberry hawthorn sedges	thin-leaved mountain alder twinberry honeysuckle common snowberry hawthorn sedges
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)	black cottonwood red-osier dogwood willows	red-osier dogwood willows	red-osier dogwood willows
	MODERATE (5 to 20% cover)	twinberry honeysuckle common snowberry roses	twinberry honeysuckle common snowberry roses	twinberry honeysuckle common snowberry roses
COMMENTS:				

DA Douglas-fir - aster vegetation landscape (Plate 2.1)				ICHe
Description: steep, southeast to west facing slopes of deep soils of colluvial or morainal material; high amount of solar radiation; dry sites				
		AFTER DISTURBANCE	YOUNG FORESTS	MATURE FORESTS
SUCCESSIONAL TRENDS	DOMINANTS	shrub-herb cover of: saskatoon Rocky Mountain maple fireweed asters	closed forests dominated by: Douglas-fir Rocky Mountain maple Oregon-grape asters	closed, edaphic climax forests of: Douglas-fir birch-leaved spirea showy aster low moss cover
	ASSOCIATES	willows soopolallie thimbleberry Oregon-grape saskatoon pine grass wild sarsaparilla	paper birch saskatoon soopolallie birch-leaved spirea pine grass wild sarsaparilla	roses common snowberry northern twinflower Lindley's aster wild sarsaparilla low cover of moss
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)	Douglas-fir	-	Douglas-fir
	MODERATE (5 to 20% cover)	Oregon boxwood Rocky Mountain maple saskatoon Oregon-grape redstem ceanothus snowbush ceanothus paper birch trembling aspen common snowberry roses choke cherry willows	Oregon boxwood Rocky Mountain maple Douglas-fir saskatoon common snowberry snowbush ceanothus roses choke cherry	Rocky Mountain maple Oregon boxwood common snowberry saskatoon roses arboreal lichens
COMMENTS: slow rate of succession; low forage potential in later stages; mature stages have sparse understory vegetation; removal of vegetation and duff layer makes these sites sensitive to erosion; pine grass may be abundant in early stages; Douglas-fir requires 200-300 years to form large canopied trees; both species of ceanothus require fire to break seed dormancy; low snow accumulation.				

Plate 2.1 Mature vegetation of the Douglas-fir - aster vegetation landscape (DA). The stand has Douglas-fir with a sparse understory of birch-leaved spirea, common snowberry and showy aster. Forage production is low, although it would improve with tree removal. Snow interception is good in these stands. This site has deep soils developed on colluvial material, on a steep south-facing slope.

Plate 2.2 Mature vegetation of the Douglas-fir - juniper vegetation landscape (DJ). This site has an open stand of Douglas-fir with an understory of saskatoon, bluebunch wheat grass and shrubby penstemon. This site has shallow soils developed on colluvial material, on a steep, south-facing slope.

DJ Douglas-fir - juniper vegetation landscape (Plate 2.2)				ICHe
Description: moderate to steep, southeast to west facing slopes of shallow soils (less than 1m); colluvial or morainal material; severe moisture deficits; high amount of solar radiation				
		AFTER DISTURBANCE	YOUNG FORESTS	MATURE FORESTS
SUCCESSIONAL TRENDS	DOMINANTS	shrub-grass dominated cover of: saskatoon common juniper bluebunch wheat grass pine grass	open forests of: Douglas-fir saskatoon common juniper bluebunch wheat grass pine grass	open forests of: Douglas-fir common juniper kinnikinnick pine grass
	ASSOCIATES	roses Oregon-grape kinnikinnick fireweed shrubby penstemon	roses Oregon-grape soopolallie Rocky Mountain juniper shrubby penstemon	Rocky Mountain juniper saskatoon bluebunch wheat grass shrubby penstemon
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)	bluebunch wheat grass	bluebunch wheat grass	Douglas-fir
	MODERATE (5 to 20% cover)	Douglas-fir saskatoon redstem ceanothus roses cherry Oregon-grape kinnikinnick shrubby penstemon	saskatoon Oregon-grape kinnikinnick roses shrubby penstemon cherry	Oregon boxwood saskatoon Oregon-grape bluebunch wheat grass shrubby penstemon cherry roses kinnikinnick
COMMENTS: bedrock outcropping is common on these sites; low forage production, particularly in later stages; variable vegetation depending on depth of materials; low snow accumulation.				

RB Western red cedar - Oregon boxwood vegetation landscape (Plate 2.3)				ICHe
Description: mesic (average sites) for this subzone; found on deep, well to moderately well drained soils of morainal, colluvial and lacustrine materials on gentle to moderate slopes; generally good moisture availability, although moisture deficits may occur in the summer				
		AFTER DISTURBANCE	**YOUNG FORESTS**	**MATURE FORESTS**
SUCCESSIONAL TRENDS	**DOMINANTS**	shrub dominated vegetation of: thimbleberry willows paper birch Oregon boxwood fireweed	close mixed forests of: paper birch Douglas-fir western red cedar Oregon boxwood thimbleberry wild sarsaparilla northern twinflower Canadian bunchberry moderate moss cover	dense coniferous forests of: western red cedar with a sparse understory of Oregon boxwood black blueberry Canadian bunchberry blue-bead clintonia moderate moss cover
	ASSOCIATES	Sitka mountain alder black blueberry northern twinflower showy aster western bracken	lodgepole pine spruce black blueberry Sitka mountain alder asters blue-bead clintonia	spruce alpine fir northern twinflower
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	**ABUNDANT (above 20% cover)**	paper birch willows Oregon boxwood Douglas-fir	Oregon boxwood	-
	MODERATE (5 to 20% cover)	black blueberry Rocky Mountain maple saskatoon red-osier dogwood twinberry honeysuckle Oregon-grape trembling aspen	alpine fir saskatoon red-osier dogwood twinberry honeysuckle willows mountain-ash Rocky Mountain maple blueberries western red cedar paper birch	mountain-ash western yew blueberries Oregon boxwood arboreal lichens
COMMENTS: severe or repeated burns may remove conifer seed source; willows may become abundant after repeated fires; Sitka mountain alder may be abundant after disturbance, particularly on sites with finer-textured soils; hybrid spruce and later stages may have a very dense cedar cover with a bare understory; hybrid spruce and alpine fir are more common on valley bottom sites which have cold air drainage; moderate to rapid rate of succession.				

Plate 2.3 Young forested vegetation of the Western red cedar - Oregon boxwood vegetation landscape (RB). The stand has paper birch with a shrub-dominated understory of thimbleberry, twinberry honeysuckle, wild sarsaparilla and wild rye grass. Forage production on similar sites is best after disturbance and includes willows, paper birch, Oregon boxwood, saskatoon, red-osier dogwood and twinberry honeysuckle. Mature forests generally have dense stands of western red cedar with a sparse understory except for a continuous moss layer. This landscape is usually associated with deep, well to moderately well drained soils developed on morainal, colluvial or lacustrine materials which have moderate slopes.

RD Western red cedar - devil's-club vegetation landscape				ICHe
Description: generally lower slope positions that receive nutrient rich seepage from upslope; imperfectly drained sites of colluvial, morainal or fluvial materials				
		AFTER DISTURBANCE	YOUNG FORESTS	MATURE FORESTS
SUCCESSIONAL TRENDS	DOMINANTS	shrub dominated vegetation of: alder thimbleberry devil's-club lady fern oak fern spiny shield fern mosses	open to closed coniferous forests of: western red cedar devil's-club alder thimbleberry lady fern oak fern spiny shield fern mosses	closed to open coniferous stands of: western red cedar devil's-club lady fern oak fern spiny shield fern moderate moss cover
	ASSOCIATES	raspberry black swamp gooseberry twinberry honeysuckle unifoliate-leaved foamflower five-leaved creeping raspberry fireweed	spruce western hemlock alpine fir unifoliate-leaved foamflower five-leaved creeping raspberry simple-stemmed twistedstalk	spruce alpine fir alder black swamp gooseberry unifoliate-leaved foamflower five-leaved creeping raspberry Canadian bunchberry simple-stemmed twistedstalk
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)	-	-	-
	MODERATE (5 to 20% cover)	blueberries twinberry honeysuckle	blueberries alpine fir mountain-ash twinberry honeysuckle	blueberries alpine fir mountain-ash twinberry honeysuckle
COMMENTS: after disturbance a persistant dense shrub cover may inhibit tree establishment; slow rate of succession to dense forests				

2.2 ICHm - MOIST CENTRAL INTERIOR CEDAR - HEMLOCK SUBZONE

This subzone is found at lower elevations, covering most of the southern and central portions of the park including areas surrounding Murtle, Azure and Clearwater Lakes, as well as areas south of Clearwater Lake.

Environment

This subzone is subjected to moderate precipitation. Most of this subzone is expected to have higher precipitation and snowfall than the ICHe subzone. Precipitation is expected to increase to the north, in the Clearwater Lake and Azure Lake area, and to the east in the Murtle Lake area (Williams, personal communication[1]).

Soils are moderately leached. Dystric Brunisols and Podzols occur throughout much of this subzone. Luvisols may occur on finer textured soils. Litter layers are moderately well developed and may become quite thick under broad-leaved forests which have a dense shrub layer.

Vegetation

Average sites within this subzone have mature communities dominated by closed forests of western hemlock and western red cedar with an abundant moss understory and a sparse cover of Oregon boxwood, black blueberry, Canadian bunchberry, northern twinflower and blue-bead clintonia. Alpine fir and hybrid spruce may be present, particularly in areas with cold air drainage. After disturbance these sites commonly have a dense shrub dominated cover of thimbleberry, willows, Oregon boxwood, black blueberry and fireweed. Sitka mountain alder may be abundant, particularly on finer textured materials. Return to seral forests is fairly rapid, although the dense shrub layer may inhibit tree establishment, particularly after repeated disturbance.

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[1]Williams, R. J. Personal communication. 1984. Air Resources, British Columbia Ministry of Environment, Kelowna, British Columbia.

South of Clearwat·r Lake and west of Murtle Lake, seral forests are dominated by Douglas-fir and paper birch, often with lodgepole pine and spruce, and have an understory of Oregon boxwood, wild sarsaparilla, northern twinflower, Canadian bunchberry and a moderate moss cover. Filbert is common at lower elevations. Trembling aspen is common in southern parts of the park and to the south of the park, within the study area. In areas surrounding Clearwater Lake and Murtle Lake, within this subzone, seral forests are dominated by western hemlock, western red cedar, spruce and Douglas-fir with an understory of abundant moss and a sparse cover of Oregon boxwood, black blueberry, northern twinflower and Canadian bunchberry. Douglas-fir is most common on southern exposures. Western white pine is common at the southeastern end of Murtle Lake.

In the southern part of the study area, on very steep southern exposures, mature forests are dominated by open to closed stands of Douglas-fir with an understory of Oregon boxwood, birch-leaved spirea and a moderate moss cover. After disturbance, persistent shrub-forb communities form and are dominated by saskatoon, common juniper, trembling aspen, soopolallie, kinnikinnick and often bluebunch wheat grass. Open seral stands are composed of trembling aspen and Douglas-fir with an understory of saskatoon, birch-leaved spirea, common juniper, kinnikinnick and often pine grass.

On moderately sloping southern exposures, mature forests consist of open to closed stands of Douglas-fir and western red cedar with an understory of Oregon boxwood, northern twinflower and a moderate moss cover. After disturbance a dense shrub cover occurs composed of willows, snowbush ceanothus, redstem ceanothus, birch-leaved spirea, Oregon boxwood, aster, kinnikinnick and fireweed. Both species of ceanothus require fire for their seeds to germinate. They would be absent or rare after clearing of mature forest stands. Seral stands are composed of Douglas-fir and lodgepole pine with an understory of saskatoon, birch-leaved spirea, Oregon boxwood, asters and kinnikinnick. These sites have a slow rate of succession.

On coarse textured soils on gently sloped or flat areas, mature forests have closed forests of western hemlock, and western red cedar with an understory of Oregon boxwood, northern twinflower, blue-bead clintonia, Canadian bunchberry and a moderate moss cover. After disturbance these dry

sites have shrub-herb dominated vegetation of Oregon boxwood, soopolallie, willows, fireweed, Canadian bunchberry and northern twinflower. Seral stands are composed of lodgepole pine and Douglas-fir with an understory of Oregon boxwood, soopolallie, Canadian bunchberry, northern twinflower and a moderate moss cover.

Wet sites within this subzone, which are associated with seepage in lower slope positions, have mature and seral forests dominated by western red cedar with an understory of devil's-club, lady fern, oak fern and spiny shield fern. Lesser amounts of western hemlock, spruce and alpine fir may occur. After disturbance a dense, shrub-dominated vegetation of alder, thimbleberry and devil's-club may develop.

Wet sites within this subzone, which have a high water table and are found in depressions develop distinctive open forests dominated by western red cedar with an understory of skunk cabbage and lady fern. Lesser amounts of spruce and western hemlock may occur. Alder may occur after disturbance.

Floodplain areas commonly have mature and seral forests of black cottonwood, red-osier dogwood, willows, rose and horsetails. After disturbance common plants include willows, thin-leaved mountain alder and red-osier dogwood.

Wetlands are present in depressional areas, although they are limited in areal extent. Two types of bogs occur. A treed bog, dominated by alpine fir, lodgepole pine, glandular birch, common Labrador tea, sedges and peat moss, occur on slightly drier areas, often with hummocks associated with them. Non-treed bogs, dominated by glandular birch, common Labrador tea, sedges and a thick layer of peat moss, also occur. Fen vegetation, dominated by sedges and mosses, occur in very wet areas which often have high water tables throughout the year. Willows and glandular birch may occur. Swamps are found along water courses and are composed of thin-leaved mountain alder, twinberry honeysuckle, hardhack, stinging nettle and cow-parsnip.

Forage Potential

Winter forage production for ungulates in this subzone increases significantly after removal of tree cover. Average sites have high potential diversity and production of forage species after disturbance. Common forage species include Scouler's willow, Oregon boxwood, Douglas-fir, paper birch and black blueberry with lesser amounts of Rocky Mountain maple, saskatoon, trembling aspen, red-osier dogwood, roses, Oregon-grape, twinberry honeysuckle, mountain-ash, alpine fir, western red cedar, western yew and arboreal lichens. Trembling aspen may be abundant particularly in southern parts of the study area. Red-osier dogwood becomes more abundant on slightly wetter sites, particularly sites with finer textured soils. Filbert is abundant at lower elevations. Paper birch and trembling aspen are rare in the Clearwater Lake, Azure Lake and Murtle Lake areas. Most of these species increase after clearing or fire. Scouler's willow responds particularly well to fires (Mueggler, 1965). After a repeated disturbance, species such as willow, paper birch, Rocky Mountain maple and red-osier dogwood resprout quickly from their bases and stems. Mature forests have low forage production, however they have good snow interception. They are, therefore, more useable by ungulates in deep snow and are especially valuable as early winter range for caribou. (Ritcey, personal communication[1]). Mature forests have moderate arboreal lichen production.

On steep, southern exposures in southern parts of the park forage production is generally low due to droughty conditions. Species present, but rarely abundant, include saskatoon, willow, trembling aspen, paper birch, Douglas-fir, Oregon boxwood, pin cherry, Oregon-grape, redstem ceanothus, roses, snowberry, shrubby penstemon, kinnikinnick and bluebunch wheat grass.

Moderately sloping southern exposures in southern parts of the park generally have good forage potential in early successional stages. After fire, which is required for seed germination of snowbush ceanothus and redstem ceanothus both species of ceanothus may be common, along with paper birch,

[1]Ritcey, R.W. 1985. Personal Communication. Fish and Wildlife Branch, British Columbia Ministry of Environment, Kamloops, British Columbia.

willows and trembling aspen. Lesser amounts of Douglas-fir, Oregon boxwood, saskatoon, roses, Oregon-grape, Rocky Mountain maple, black blueberry, bluebunch wheat grass and kinnikinnick occur. Most of these species, except Oregon boxwood, are fairly intolerant of shade.

Gently-sloped areas with shallow soils over rock or coarse-textured soils have low to moderate forage production. Common species include Douglas-fir and Oregon boxwood with lesser amounts of willows, blueberries, saskatoon, paper birch, mountain-ash, Rocky Mountain maple, roses, Oregon-grape, alpine fir and kinnikinnick.

Wetter sites, which have devil's-club or skunk cabbage communities have low forage potential. Species include a sparse cover of blueberries, alpine fir, mountain-ash and twinberry honeysuckle.

Floodplain areas, although limited in extent, have abundant forage potential through all stages of succession. Common species include red-osier dogwood, willows, roses, common snowberry and twinberry honeysuckle. Black cottonwood is available and abundant after disturbance.

Wetland communities may provide good forage availability. Often willows surround the wetlands. Some bog areas have abundant sedges and may have abundant glandular birch. Fen areas have abundant sedges and may have good production of willows and glandular birch. Swamps often have moderate availability of twinberry honeysuckle, red-osier dogwood, willows and sedges.

The following fourteen Vegetation Landscapes have been recognized within this subzone. Figure 2.2 depicts the positional relationship of these vegetation landscapes to each other.

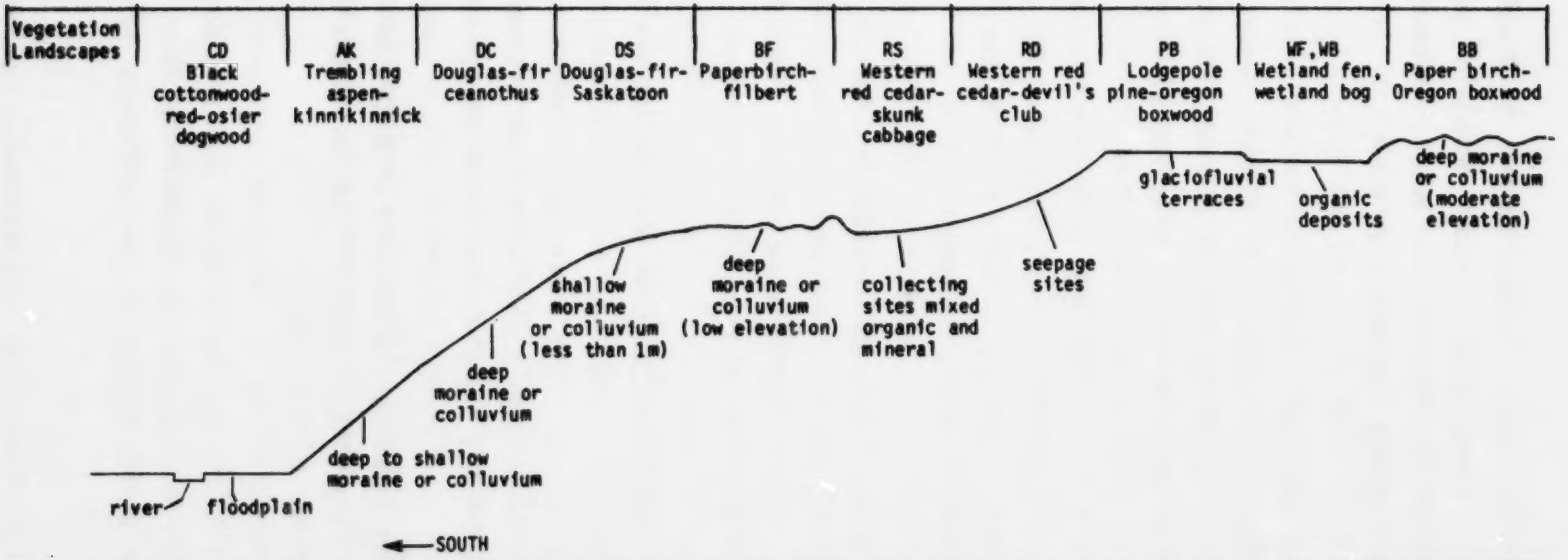

Figure 2.2 The relationship of vegetation landscapes in the terrain for the Moist, Central, Interior Cedar-Hemlock Subzone (ICHm) (for descriptions of the vegetation landscapes, see the text).

AK Trembling aspen - kinnikinnick vegetation landscape (Plate 2.4)				ICHm
Description: steep, southeast to west facing slopes of deep to shallow (less than 1m) soils of colluvial or morainal material; very dry sites with rapid runoff and high solar radiation.				
		AFTER DISTURBANCE	YOUNG FORESTS	MATURE FORESTS
SUCCESSIONAL TRENDS	DOMINANTS	shrub dominated vegetation of: saskatoon common juniper soopolallie asters kinnikinnick spreading dogbane	open forests of: trembling aspen saskatoon birch-leaved spirea common juniper kinnikinnick	open to closed edaphic climax forests of: Douglas-fir Oregon boxwood birch-leaved spirea northern twinflower moderate moss cover
	ASSOCIATES	trembling aspen snowberry Rocky Mountain maple willow bluebunch wheat grass pine grass	Douglas-fir soopolallie Rocky Mountain maple Oregon boxwood pine grass asters	Rocky Mountain maple roses common western pipsissewa pine grass
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)	-	-	Douglas-fir
	MODERATE (5 to 20% cover)	Rocky Mtn. maple trembling aspen paper birch saskatoon willow Oregon boxwood pin cherry Oregon-grape bluebunch wheat grass redstem ceanothus shrubby penstemon kinnikinnick snowberry roses Douglas-fir	Rocky Mountain maple roses saskatoon willow Oregon boxwood Oregon-grape kinnikinnick snowberry Douglas-fir	Oregon boxwood roses
COMMENTS: sensitive to disturbances; vegetation cover protects the soils from excessive erosion; pine grass may be abundant on some sites; very slow rate of succession; low snow accumulation.				

Plate 2.4 Disturbance vegetation of the Trembling aspen - kinnikinnick vegetation landscape (AK). This fire-created vegetation is dominated by a sparse cover of trembling aspen with a moderate shrub cover of saskatoon, soopolallie and Rocky Mountain maple and a moderate herb cover of pine grass, kinnikinnick, showy aster and bluebunch wheat grass. Mature forests on similar sites are expected to have open to closed stands of Douglas-fir with a sparse understory. This dry site is found on a very steep west aspect with a mixture of deep and shallow colluvial materials.

BB Paper birch - Oregon boxwood vegetation landscape (Plate 2.5)				ICHm
Description: mesic (average) sites for south-central areas of the park and south of park boundary; found on deep, well to moderately well drained soils of morainal, colluvial and fluvial materials; generally good moisture availability although moisture deficits may occur in the summer; extensive landscape				
		AFTER DISTURBANCE	**YOUNG FORESTS**	**MATURE FORESTS**
SUCCESSIONAL TRENDS	**DOMINANTS**	shrub dominated vegetation of: thimbleberry willows paper birch Oregon boxwood fireweed	dense mixed forests of: paper birch Douglas-fir Oregon boxwood thimbleberry wild sarsaparilla northern twinflower Canadian bunchberry moderate moss cover	dense coniferous forests of: western hemlock western red cedar with a dense cover of moss
	ASSOCIATES	Sitka mountain alder black blueberry trembling aspen northern twinflower aster western bracken	trembling aspen spruce lodgepole pine Sitka mountain alder aster blue-bead clintonia soopolallie	alpine fir spruce Oregon boxwood blueberries Canadian bunchberry northern twinflower blue-bead clintonia
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	**ABUNDANT (above 20% cover)**	paper birch willows Oregon boxwood Douglas-fir	Oregon boxwood	-
	MODERATE (5 to 20% cover)	trembling aspen black blueberry Rocky Mountain maple saskatoon red-osier dogwood roses Oregon-grape	saskatoon twinberry honeysuckle red-osier dogwood willows mountain-ash Rocky Mountain maple black blueberry western red cedar alpine fir roses paper birch	moutain-ash western yew blueberries arboreal lichens Oregon boxwood
COMMENTS: good forage availability and diversity after disturbance; trembling aspen is often the dominant seral tree south of the park boundary and in areas that have been severely burned, such as along the road to Stillwater; severe or repeated burns may remove conifer seed source; Sitka mountain alder may be abundant after disturbance, particularly on sites with finer-textured soils; willows may become abundant after repeated fires; hybrid spruce and alpine fir are more common on valley bottom sites which have cold air drainage; moderate rate of succession				

Plate 2.5(a)

Plate 2.5(b)

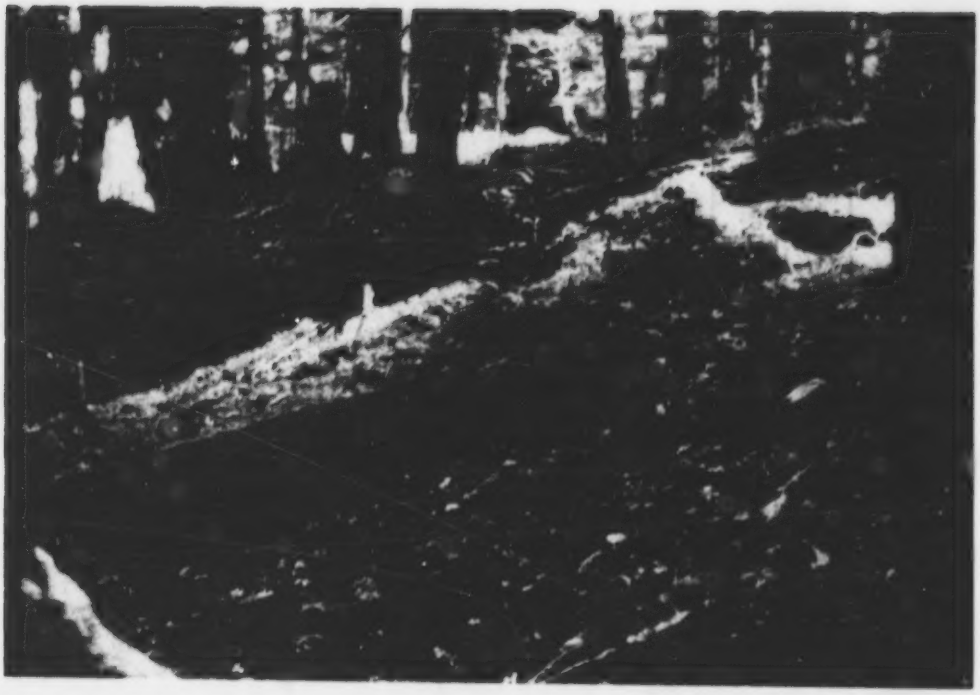

Plate 2.5(c)

Plate 2.5(a,b,c) Three successional stages of the Paper birch - Oregon boxwood vegetation landscape (BB). This landscape is found on moderate sloping areas with deep, well to moderately well drained soils developed on morainal or colluvial material. It is a widespread landscape. Plate 2.5(a) shows vegetation after disturbance, dominated by a dense shrub layer of Scouler's willow, soopolallie, paper birch, trembling aspen, birch-leaved spirea, saskatoon, Rocky Mountain maple and thimbleberry, with a herb layer of showy aster and Canadian bunchberry. Forage production is high. Plate 2.5 (b) shows young, forested vegetation dominated by paper birch, Douglas-fir and lodgepole pine with a shrub-dominated understory of Oregon boxwood, thimbleberry, alder, willow, black blueberry, red-osier dogwood, Canadian bunchberry and wild sarsaparilla. Plate 2.5(c) shows mature, forested vegetation dominated by western hemlock and western red cedar with a moss dominated understory of layered moss, common moss and feather moss and a sparse cover of blueberry, five-leaved creeping raspberry, blue-bead clintonia and Canadian bunchberry. Low to moderate amounts of arboreal lichens occur in this stage. This stage is similar to the mature stage of the western hemlock - Oregon boxwood (HB) vegetation landscape.

BD Paper birch - red-osier dogwood vegetation landscape				ICHm
Description: moderately well to imperfectly drained soils of morainal or fluvial materials; found on flat-lying or depressional sites on Green Mountain				
		AFTER DISTURBANCE	YOUNG FORESTS	MATURE FORESTS
SUCCESSIONAL TRENDS	DOMINANTS	shrub dominated vegetation of: paper birch thimbleberry red-osier dogwood willow fireweed	dense broad-leaved forests of: paper birch thimbleberry red-osier dogwood Oregon boxwood northern twinflower Canadian bunchberry	dense coniferous forests of: western red cedar blueberries unifoliate-leaved foamflower oak fern Canadian bunchberry dense cover of mosses
	ASSOCIATES	Oregon boxwood twinberry honeysuckle northern twinflower Canadian bunchberry	western red cedar spruce twinberry honeysuckle Rocky Mountain maple Sitka mountain alder wild sarsaparilla palmate colt's-foot oak fern	western hemlock spruce devil's-club Oregon boxwood blue-bead clintonia rough-fruited fairybells
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)	paper birch	red-osier dogwood	-
	MODERATE (5 to 20% cover)	willow red-osier dogwood saskatoon Oregon boxwood Rocky Mountain maple	willow paper birch high bush cranberry Oregon boxwood twinberry honeysuckle Rocky Mountain maple roses mountain-ash saskatoon black blueberry	blueberries twinberry honeysuckle alpine fir high bush cranberry Oregon boxwood mountain-ash arboreal lichens
COMMENTS: devil's-club may be present on this landscape; repeated disturbance could cause a persistent shrub layer dominated by willow and alder to occur; the thick deciduous litter may inhibit conifer regeneration and blueberry establishment				

BF Paper birch - filbert vegetation landscape (Plate 2.6)				ICHm
Description: submesic to mesic (average) sites for lower elevations (below 750 m) of the park; along Clearwater River and at southern entrance to park; found on deep, well to moderately well drained soils of morainal and fluvial materials; generally good moisture availability, although moisture deficits may occur in the summer				
		AFTER DISTURBANCE	**YOUNG FORESTS**	**MATURE FORESTS**
SUCCESSIONAL TRENDS	**DOMINANTS**	shrub dominated vegetation of: thimbleberry filbert willows paper birch wild sarsaparilla Oregon boxwood northern twinflower fireweed	dense mixed forests of: paper birch Douglas-fir filbert thimbleberry Oregon boxwood wild sarsaparilla	dense coniferous forests of: western hemlock western red cedar with a dense cover of moss
	ASSOCIATES	Douglas-fir saskatoon Rocky Moutain maple Canadian bunchberry western bracken	western red cedar trembling aspen spruce saskatoon twinberry honeysuckle Canadian bunchberry northern twinflower	spruce Oregon boxwood blueberries Canadian bunchberry northern twinflower blue-bead clintonia
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	**ABUNDANT (above 20% cover)**	paper birch Oregon boxwood filbert Douglas-fir	filbert Oregon boxwood	western red cedar
	MODERATE (5 to 20% cover)	trembling aspen willow saskatoon red-osier dogwood Rocky Mountain maple Oregon-grape twinberry honeysuckle	western red cedar saskatoon red-osier dogwood Rocky Mountain maple Oregon-grape twinberry honeysuckle black blueberry paper birch	Oregon boxwood blueberries arboreal lichens
COMMENTS: severe or repeated burns may remove conifer seed source; willows may become abundant after repeated fires; the dense, broad-leaved tree and shrub species present, create a thick litter layer that may inhibit conifer regeneration; moderate rate of succession				

Plate 2.6 Young forested vegetation of the Paper birch - filbert vegetation landscape (BF). The stand has paper birch and Douglas-fir with a dense shrub-dominated understory of filbert, thimbleberry, saskatoon, Oregon boxwood, Canadian bunchberry and wild sarsaparilla. Forage production is good on this landscape, particularly after disturbance. This site has a gentle slope with deep, well drained soils developed on fluvial material. This landscape is also associated with morainal materials.

Plate 2.7 Young, open forested vegetation of the Douglas-fir - ceanothus vegetation landscape (DC). This stand has an open forest of Douglas-fir with an understory of birch-leaved spirea, soopolallie, redstem ceanothus, saskatoon, rose, abundant pine grass and kinnikinnick. Forage production for this landscape is moderate and may include snowbush ceanothus. This site has a moderately steep slope on a southwest aspect with shallow soil developed on colluvial material. This landscape is also found on deeper materials and is usually associated with southern exposures.

CD Black cottonwood - red-osier dogwood vegetation landscape				ICHm
Description: found on level floodplain areas subject to yearly inundation; soils are imperfectly to poorly drained and subject to yearly deposition				
		AFTER DISTURBANCE	YOUNG FORESTS	MATURE FORESTS
SUCCESSIONAL TRENDS	DOMINANTS	shrub dominated vegetation of: willows thin-leaved mountain alder black cottonwood red-osier dogwood	dense broad-leaved forests of: black cottonwood red-osier dogwood willows bristly Nootka rose horsetails	dense broad-leaved forests of: black cottonwood red-osier dogwood willows bristly Nootka rose horsetails
	ASSOCIATES	rose twinberry honeysuckle horsetails sedges common pink pyrola Lindley's aster	thin-leaved mountain alder twinberry honeysuckle common snowberry hawthorn sedges	thin-leaved mountain alder twinberry honeysuckle common snowberry hawthorn sedges
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)	black cottonwood red-osier dogwood willows rose	red-osier dogwood willows roses	red-osier dogwood willows roses
	MODERATE (5 to 20% cover)	twinberry honeysuckle common snowberry	twinberry honeysuckle common snowberry	twinberry honeysuckle common snowberry
COMMENTS: shrub cover is dense through all stages of succession				

DC Douglas-fir - ceanothus vegetation landscape (Plate 2.7)				ICHm
Description: moderately steep, southeast to west facing slopes of various materials; high amounts of solar radiation; droughty sites in the summer				
		AFTER DISTURBANCE	YOUNG FORESTS	MATURE FORESTS
SUCCESSIONAL TRENDS	DOMINANTS	shrub dominated vegetation of: willows snowbush ceanothus redstem ceanothus birch-leaved spirea asters kinnikinnick fireweed	open to closed forests of: Douglas-fir saskatoon snowbush ceanothus birch-leaved spirea asters kinnikinnick	open to closed edaphic climax forests of: Douglas-fir western red cedar Oregon boxwood northern twinflower moderate moss cover
	ASSOCIATES	soopolallie Oregon boxwood saskatoon pine grass pussytoes	lodgepole pine Oregon boxwood soopolallie asters pine grass	blueberries common western pipsissewa pyrola
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)			
	MODERATE (5 to 20% cover)	Douglas-fir paper birch trembling aspen willows snowbush ceanothus redstem ceanothus Oregon boxwood bluebunch wheat grass saskatoon roses Oregon-grape Rocy Mtn. maple black blueberry kinnikinnick	snowbush ceanothus Oregon boxwood saskatoon roses Oregon-grape Rocky Mountain maple black blueberry kinnikinnick bluebunch wheat grass	Oregon boxwood Rocky Moutain maple blueberries
COMMENTS: both species of ceanothus require fire for their seeds to germinate; ceanothus may be abundant in early stages; pine grass may be abundant and bluebunch wheat grass may occur in southern parts of the study area; after severe or repeated fires trembling aspen may form seral stands; slow rate of succession.				

DS Douglas-fir - saskatoon vegetation landscape (Plate 2.8)				ICHm
Description: shallow (less than 1 m) soils of morainal or colluvial materials; often with bedrock outcrops; usually on gentle to moderately sloped areas				
		AFTER DISTURBANCE	YOUNG FORESTS	MATURE FORESTS
SUCCESSIONAL TRENDS	DOMINANTS	shrub-herb dominated vegetation of: willows Oregon boxwood saskatoon fireweed	open to closed forests dominated by: Douglas-fir Oregon boxwood saskatoon asters	open to closed stands of: western hemlock with a dense cover of mosses
	ASSOCIATES	Rocky Mountain maple soopolallie pine grass kinnikinnick pussytoes arctic lupine	lodgepole pine soopolallie birch-leaved spirea northern twinflower pussytoes kinnikinnick	western red cedar Douglas-fir Oregon boxwood blueberries blue-bead clintonia northern twinflower
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)	Douglas-fir	-	-
	MODERATE (5 to 20% cover)	willow Oregon boxwood saskatoon paper birch mountain-ash Rocky Mountain maple roses Oregon-grape kinnikinnick	willow Oregon boxwood saskatoon twinberry honeysuckle black blueberry mountain-ash Rocky Mountain maple roses Oregon-grape kinnikinnick	blueberries Oregon boxwood
COMMENTS: pine grass may be abundant in early stages of this landscape in southern areas of the park and south of the park; alder may be common in early stages				

Plate 2.8 Recent disturbance vegetation of the Douglas-fir - saskatoon vegetation landscape (DS). This stand has a moderate shrub cover of Scouler's willow, soopolallie, Oregon boxwood and saskatoon with a herb layer of abundant arctic lupine with fireweed and aster. Forage production for this landscape is moderate in early successional stages. This site has a gentle slope with shallow, well drained soils developed on morainal material.

HB Western hemlock - Oregon boxwood vegetation landscape				ICHm
Description: mesic (average) sites for more northern and eastern areas of this subzone				
		AFTER DISTURBANCE	YOUNG FORESTS	MATURE FORESTS
SUCCESSIONAL TRENDS	DOMINANTS	shrub-young tree dominated vegetation of: Douglas-fir willows thimbleberry Oregon boxwood fireweed	dense coniferous forests of: Douglas-fir spruce western hemlock western red cedar Oregon boxwood thimbleberry moss	dense coniferous forests of: western hemlock western red cedar with a dense cover of moss
	ASSOCIATES	western hemlock western red cedar lodgepole pine black blueberry northern twinflower Canadian bunchberry western bracken	alpine fir black blueberry northern twinflower Canadian bunchberry blue-bead clintonia	alpine fir spruce Oregon boxwood blueberries northern twinflower Canadian bunchberry blue-bead clintonia five-leaved creeping raspberry
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)	willows Douglas-fir	Oregon boxwood	-
	MODERATE (5 to 20% cover)	Oregon boxwood black blueberry western red cedar	blueberries twinberry honeysuckle mountain-ash alpine fir high bush cranberry western yew	arboreal lichens Oregon boxwood blueberries alpine fir western yew
COMMENTS: rapid rate of succession; Douglas-fir is more common on southern exposures; hybrid spruce and alpine fir are more common in valley botton sites which have cold air drainage where Oregon boxwood is rare; white pine is common east of Murtle Lake; this unit occurs surrounding Murtle and Clearwater Lakes				

PB Lodgepole pine - Oregon boxwood vegetation landscape				ICHm
Description: coarse-textured soils of fluvial material; usually on gentle slopes or terraces; drier than average sites				
		AFTER DISTURBANCE	YOUNG FORESTS	MATURE FORESTS
SUCCESSIONAL TRENDS	DOMINANTS	shrub-herb vegetation dominated by: Oregon boxwood soopolallie willows fireweed Canadian bunchberry northern twinflower	closed coniferous forests of: lodgepole pine Oregon boxwood soopolallie Canadian bunchberry northern twinflower mosses	closed coniferous forests of: western hemlock western red cedar Oregon boxwood northern twinflower blue-bead clintonia Canadian bunchberry moderate moss cover
	ASSOCIATES	thimbleberry black blueberry saskatoon birch-leaved spirea	Douglas-fir spruce black blueberry wild sarsaparilla common western pipsissewa	spruce alpine fir black blueberry common western pipsissewa
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)	Oregon boxwood	Oregon boxwood	-
	MODERATE (5 to 20% cover)	willow saskatoon blueberries paper birch Douglas-fir	willow blueberries saskatoon alpine fir	Oregon boxwood blueberries alpine fir arboreal lichens
COMMENTS: severe or repeated disturbance may remove the duff layer which is valuable in providing nutrients and moisture; slow rate of succession; this kind of vegetation may occur on coarse textured morainal material				

RD Western red cedar - devil's-club vegetation landscape				ICHm
Description: lower slope positions that receive nutrient rich seepage from upslope; imperfectly drained soils of colluvial, morainal or fluvial materials				
		AFTER DISTURBANCE	YOUNG FORESTS	MATURE FORESTS
SUCCESSIONAL TRENDS	DOMINANTS	shrub dominated vegetation of: alder thimbleberry devil's-club lady fern oak fern spiny shield fern mosses	open to closed coniferous forests of: western red cedar devil's-club alder thimbleberry lady fern oak fern spiny shield fern mosses	closed to open coniferous stands of: western red cedar devil's-club lady fern oak fern spiny shield fern mosses
	ASSOCIATES	raspberry black swamp gooseberry unifoliate-leaved foamflower five-leaved creeping raspberry fireweed	spruce western hemlock alpine fir black swamp gooseberry unifoliate-leaved foamflower five-leaved creeping raspberry simple-stemmed twistedstalk	spruce western hemlock alder black swamp gooseberry unifoliate-leaved foamflower five-leaved creeping raspberry simple-stemmed twistedstalk
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)	-	-	-
	MODERATE (5 to 20% cover)	blueberries	Rocky Mountain maple blueberries alpine fir mountain-ash	Rocky Mountian maple blueberries alpine fir mountain-ash
COMMENTS: after disturbances a persistent dense shrub cover may inhibit tree establishment; slow rate of succession to dense forests				

RS Western red cedar - skunk cabbage vegetation landscape				ICHm
Description: wet, collecting sites with a high water table at the base of slopes and in depressions; may have a thick organic layer over mineral soil				
		AFTER DISTURBANCE	YOUNG FORESTS	MATURE FORESTS
SUCCESSIONAL TRENDS	DOMINANTS	shrub dominated cover of: alder skunk cabbage lady fern moderate moss and liverwort cover	open coniferous forests of: western red cedar skunk cabbage lady fern moderate moss and liverwort cover	open coniferous forests of: western red cedar skunk cabbage lady fern moderate moss and liverwort cover
	ASSOCIATES	devil's-club Canadian bunchberry horsetails western bracken	spruce western hemlock devil's-club Canadian bunchberry horsetails oak fern	spruce western hemlock blueberries devil's-club Canadian bunchberry horsetails oak fern
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)	-	-	-
	MODERATE (5 to 20% cover)	twinberry honeysuckle blueberries	twinberry honeysuckle blueberries alpine fir	twinberry honeysuckle blueberries alpine fir
COMMENTS: after disturbance a persistent dense cover of alder may occur; tree establishment is slow				

WB Wetland bog vegetation landscape			ICHm
DESCRIPTION:		DOMINANT TYPE	ASSOCIATED TYPE
		depressional areas that receive most of its water from precipitation; usually acidic, organic substrate; permanently high water table	hummocky areas; usually acidic, organic substrate; permanently high water table
VEGETATION	DOMINANTS	glandular birch common Labrador tea sedges dense, thick cover of peat moss	open treed bog of: alpine fir lodgepole pine spruce glandular birch common Labrador tea sedges peat moss
	ASSOCIATES	cotton-grass horsetails sundew marsh cinquefoil buckbean	hummocks with Pacific menziesia oval-leaved blueberry white-flowered rhododendron five-leaved creeping raspberry moderate moss cover
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)	glandular birch sedges	glandular birch sedges
	MODERATE (5 to 20% cover)	-	blueberries
COMMENTS: hardhack may surround these sites			

WF Wetland fen vegetation landscape complex			ICHm
		DOMINANT TYPE	ASSOCIATED TYPE
DESCRIPTION:		organic substrate; high water table; seasonally inundated; receives moisture and nutrients from upslope	organic substrate often with mineral material within 1 metre of the surface; high water table; seasonally inundated; receives moisture and nutrients from upslope
VEGETATION	DOMINANTS	sedge fen vegetation of: sedges Drepanocladus spp.	shrub-sedge vegetation of: willows glandular birch sedges buckbean bluejoint small reed grass Drepanocladus spp.
	ASSOCIATES		
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)	sedges	willow glandular birch sedges
	MODERATE (5 to 20% cover)		
COMMENTS: the sedge fen vegetation occurs on slightly wetter habitats, usually at the bottom of depressions; these areas may slowly succeed to bogs			

WS Wetland swamp vegetation landscape		ICHm
DESCRIPTION:	periodic flooding; nearly permanent subsurface water flow through various proportions of mineral and organic material; usually associated with creeks	
VEGETATION	DOMINANTS	dense shrub thicket dominated by: thin-leaved mountain alder twinberry honeysuckle hardhack stinging nettle cow-parsnip
	ASSOCIATES	spruce red-osier dogwood willows bent grass sedges
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)	-
	MODERATE (5 to 20% cover)	twinberry honeysuckle red-osier dogwood willows sedges
COMMENTS:	edaphic climax shrub community; cold air drainage areas in valley bottoms	

2.3 ICHw - WET CENTRAL INTERIOR CEDAR - HEMLOCK SUBZONE

This subzone occurs at higher elevations above the ICHm subzone in the central part of the park, in the vicinity of Clearwater Lake, Azure Lake and the west arm of Murtle Lake. The subzone also occurs in valley bottoms along Hobson Lake and north-east of Azure Lake, along the north arm of Murtle Lake, and north of Murtle Lake.

Environment

This subzone receives more precipitation, including higher snowfall, than the ICHm and ICHe. Temperatures are generally colder than the other two subzones, due to being at higher elevations. Soils are moderately to deeply leached and are mainly classified as Podzols.

Vegetation

Average sites have mature forests are dominated by closed stands of western hemlock with lesser amounts of western red cedar. The herb rich understory is dominated by oak fern, unifoliate-leaved foamflower, blue-bead clintonia, five-leaved creeping raspberry, simple-stemmed twistedstalk, Canadian bunchberry and a moderate moss cover. Alpine fir and spruce are common at higher elevations and in areas with cold air drainage. After disturbance, shrub-herb communities are dominated by willows, black blueberry, fireweed, oak fern and blue-bead clintonia. Seral forests are very similar to mature forests with the same tree species present.

On drier sites which have steep southern exposures, mature forests are dominated by western hemlock with lesser amounts of western red cedar and a sparse understory of blueberries, Oregon boxwood, northern twinflower, Canadian bunchberry and a moderate to dense moss layer. After disturbance a shrub-herb cover of willows, blueberries, Oregon boxwood, fireweed and northern twinflower develops. Seral forests are dominated by Douglas-fir and western hemlock, with lesser amounts of lodgepole pine and an understory of blueberries, Oregon boxwood, northern twinflower, Canadian bunchberry and a moderate moss cover.

Wet sites within this subzone, which are associated with seepage in lower slope positions, have mature and seral forests dominated by western red cedar with an understory of devil's-club, lady fern, oak fern and spiny shield fern. Lesser amounts of western hemlock, spruce and alpine fir may occur. After disturbance a dense shrub-dominated vegetation of alder, thimbleberry and devil's-club may develop. This vegetation is common in steep sided valleys and at the base of many slopes.

Wet sites within this subzone, which have a high water table, and are found at the base of slopes develop distinctive open forests dominated by western red cedar with an understory of skunk cabbage and lady fern. Lesser amounts of spruce and western hemlock may occur. Alder may occur after disturbance.

Floodplain areas commonly have mature and seral forests of black cottonwood, red-osier dogwood, willows, bristly Nootka rose and horsetails. After disturbance common plants include willows, thin-leaved mountain alder and red-osier dogwood.

Wetlands are present in depressional areas, although they are limited in areal extent. Two types of bogs are found. A treed bog, dominated by alpine fir, lodgepole pine, glandular birch, common Labrador tea, sedges and peat moss is present on slightly drier areas, often with hummocks associated with them. Non-treed bogs, dominated by glandular birch, common Labrador tea, sedges and a thick layer of peat moss, also occur. Fen vegetation, dominated by sedges and mosses, occur in very wet areas which often have high water tables throughout the year. Willows and glandular birch may be present.

Snow avalanches are common in this subzone, particularly on steeper sloped areas. Most avalanches begin in the upper parts of the Engelmann Spruce - Subalpine Fir Biogeoclimatic Zone or the Alpine Tundra Zone. Vegetation is dominated by dense shrub communities of Sitka mountain alder, devil's-club, spiny shield fern, oak fern and lady fern.

Forage Potential

Forage potential is limited within this subzone and as well, deep snow may prevent its utilization in winter. Forage production is optimal after disturbances. Average sites have moderate forage potential which consists of blueberries, Rocky Mountain maple, saskatoon, twinberry honeysuckle, willows, high bush cranberry, alpine fir, Douglas-fir and Oregon boxwood. Arboreal lichens have moderate abundance in mature forests.

On southern exposures forage potential is also moderate and consists of willows, blueberries, saskatoon, Oregon boxwood and Douglas-fir.

Wetter sites, which have devil's-club or skunk cabbage communities, have low forage potential. Species include a sparse cover of Rocky Mountain maple, blueberries, alpine fir, mountain-ash and twinberry honeysuckle.

Floodplain areas, although limited in extent have abundant forage potential through all stages of succession. Common species include red-osier dogwood, willows and twinberry honeysuckle. Black cottonwood is available and abundant after disturbance.

Wetland communities may provide good forage productivity. Often a margin of willows surround the wetlands. Bog areas have moderate sedges and may have abundant glandular birch. Fen areas have abundant sedges and may have good production of willows and glandular birch.

Avalanche areas have low forage availability for ungulates, but high for grizzly bear.

The following eight Vegetation Landscapes have been recognized within this subzone.

AS Sitka mountain alder - spiny shield fern vegetation landscape ICHw		
DESCRIPTION: steep sloped areas of avalanche chute; soil subject to seepage		
VEGETATION	DOMINANTS	dense shrub dominated, disturbance climax of: Sitka mountain alder spiny shield fern oak fern lady fern
	ASSOCIATES	black swamp gooseberry devil's-club simple-stemmed twistedstalk unifoliate-leaved foamflower
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)	-
	MODERATE (5 to 20% cover)	elder
COMMENTS: snow avalanches common in winter; damage from snow and competition prevent tree establishment on steep slopes; common in steeper valleys		

CD Black cottonwood - red-osier dogwood vegetation landscape (Plate 2.9)				ICHw
Description: found on level floodplain areas subject to yearly inundation; soils are poorly drained and subject to yearly deposition				
		AFTER DISTURBANCE	YOUNG FORESTS	MATURE FORESTS
SUCCESSIONAL TRENDS	DOMINANTS	shrub dominated vegetation of: willows thin-leaved mountain alder black cottonwood red-osier dogwood	dense broad-leaved forests of: black cottonwood red-osier dogwood willows horsetails	dense broad-leaved forests of: black cottonwood red-osier dogwood willows horsetails
	ASSOCIATES	rose twinberry honeysuckle horsetails sedges common pink pyrola	thin-leaved mountain alder twinberry honeysuckle sedges	thin-leaved mountain alder twinberry honeysuckle sedges
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)	black cottonwood red-osier dogwood willows	red-osier dogwood willows	red-osier dogwood willows
	MODERATE (5 to 20% cover)	twinberry honeysuckle common snowberry	twinberry honeysuckle common snowberry	twinberry honeysuckle common snowberry
COMMENTS: shrub cover is dense through all stages of succession; subject to cold air drainage.				

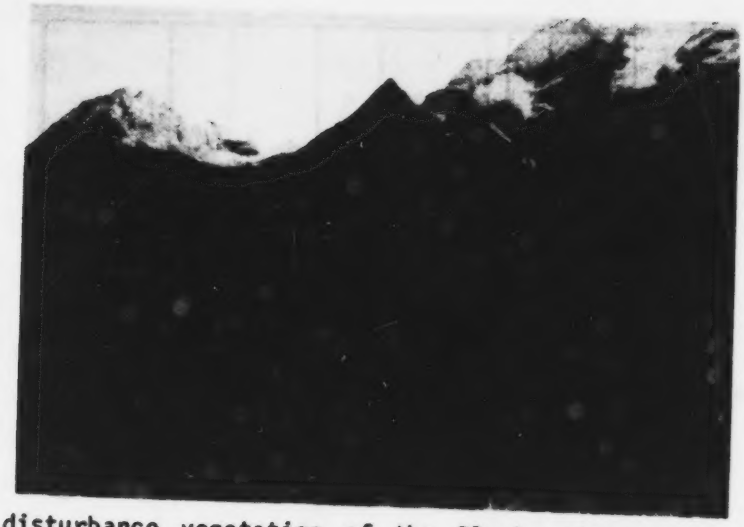

Plate 2.9 Recent disturbance vegetation of the Black cottonwood - red-osier dogwood vegetation landscape (CD), caused by flooding. This site is at the inlet to Hobson Lake. It has dense, shrub-dominated vegetation of alder, willow, red-osier dogwood, twinberry honeysuckle and black cottonwood. This site is a level floodplain. This landscape occurs in the ICHe and ICHm.

Plate 2.10 Typical, mature vegetation of the Western hemlock - oak fern vegetation landscape (HO). This site is dominated by a dense forest of western hemlock and western red cedar with a herb dominated understory of blueberries, oak fern, blue-bead clintonia, simple-stemmed twistedstalk, unifoliate-leaved foamflower, layered moss and common moss. This site has moderately well drained soils developed on fluvial materials. This landscape is also found on morainal and colluvial materials.

DB Douglas-fir - blueberry vegetation landscape				ICHw
Description: steep, southeast to west facing slopes; usually of deep to shallow (less than 1m) soils of colluvial materials				
		AFTER DISTURBANCE	YOUNG FORESTS	MATURE FORESTS
SUCCESSIONAL TRENDS	DOMINANTS	shrub-herb cover of: willows blueberries Oregon boxwood fireweed northern twinflower	closed coniferous forests of: Douglas-fir western hemlock blueberries Oregon boxwood northern twinflower Canadian bunchberry moderate moss cover	closed coniferous forests of: western hemlock sparse shrub-herb layers of: blueberries Oregon boxwood northern twinflower Canadian bunchberry moderate to dense moss cover
	ASSOCIATES	Oregon boxwood soopolallie birch-leaved spirea Canadian bunchberry	lodgepole pine western red cedar Pacific menziesia soopolallie blue-bead clintonia common western pipsissewa	western red cedar Pacific menziesia blue-bead clintonia common western pipsissewa
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)	-	-	-
	MODERATE (5 to 20% cover)	willow blueberries saskatoon Oregon boxwood Douglas-fir	blueberries Oregon boxwood	blueberries Oregon boxwood
COMMENTS: sparse understory in later stages although the moss layer is abundant; on steep slopes removal of vegetation and the duff layer may make the soils sensitive to erosion; low forage productivity				

HO Western hemlock - oak fern vegetation landscape (Plate 2.10)				ICHw
Description: mesic (average) sites for this subzone; found on deep, well to moderately well drained soils of morainal and colluvial materials; generally good moisture availability; podzolic soils				
		AFTER DISTURBANCE	YOUNG FORESTS	MATURE FORESTS
SUCCESSIONAL TRENDS	DOMINANTS	shrub-herb cover of: willows black blueberry fireweed oak fern blue-bead clintonia	closed coniferous forests of: western hemlock western red cedar oak fern unifoliate-leaved foamflower blue-bead clintonia simple-stemmed twistedstalk moderate moss cover	closed coniferous forests of: western hemlock western red cedar oak fern unifoliate-leaved foamflower blue-bead clintonia simple-stemmed twistedstalk moderate moss cover
	ASSOCIATES	thimbleberry Oregon boxwood Canadian bunchberry simple-stemmed twistedstalk	Douglas-fir wild sarsaparilla black blueberry five-leaved creeping raspberry northern twinflower Canadian bunchberry	alpine fir black blueberry five-leaved creeping raspberry Canadian bunchberry northern twinflower
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)	-	-	-
	MODERATE (5 to 20% cover)	black blueberry Rocky Mountain maple saskatoon twinberry honeysuckle willows high bush cranberry alpine fir Douglas-fir Oregon boxwood	alpine fir willow	blueberries Oregon boxwood arboreal lichens alpine fir
COMMENTS: alpine fir and spruce may be common in this type in valley bottom areas or at upper elevations of this subzone; Douglas-fir is most common on southern exposures				

RD Western red cedar - devil's-club vegetation landscape (Plate 2.11)				ICHw
Description: generally lower slope positions the receive nutrient rich seepage from upslope; imperfectly drained sites of colluvial, morainal or fluvial materials				
		AFTER DISTURBANCE	YOUNG FORESTS	MATURE FORESTS
SUCCESSIONAL TRENDS	DOMINANTS	shrub dominated vegetation of: alder thimbleberry devil's-club lady fern oak fern spiny shield fern mosses	open to closed coniferous forests of: western red cedar devil's-club alder thimbleberry lady fern oak fern spiny shield fern mosses	closed to open coniferous stands of: western red cedar devil's-club lady fern oak fern spiny shield fern mosses
	ASSOCIATES	raspberry black swamp gooseberry unifoliate-leaved foamflower five-leaved creeping raspberry fireweed	spruce western hemlock alpine fir black swamp gooseberry unifoliate-leaved foamflower five-leaved creeping raspberry simple-stemmed twistedstalk	spruce western hemlock alder black swamp gooseberry unifoliate-leaved foamflower five-leaved creeping raspberry simple-stemmed twistedstalk
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)	-	-	-
	MODERATE (5 to 20% cover)	blueberries	blueberries alpine fir mountain-ash	blueberries alpine fir mountain-ash
COMMENTS: after disturbance a persistent dense shrub cover may inhibit tree establishment; slow rate of succession to dense forests				

Plate 2.11 Typical, mature vegetation of the Western red cedar - devil's-club vegetation landscape (RD). The vegetation has an open forest of western red cedar, alpine fir and western hemlock with a lush understory of devil's-club, alder, oval-leaved blueberry, spiny shield fern, lady fern, oak fern, unifoliate-leaved foamflower and moss. These sites receive nutrient rich seepage from upslope. This landscape usually occurs in lower slope positions. It is also found in the ICHe, ICHm and ICHv.

RS Western red cedar - skunk cabbage vegetation landscape				ICHw
Description: wet, collecting sites with a high water table at the base of slopes and in depressions; may have a thick organic layer over mineral soil				
		AFTER DISTURBANCE	YOUNG FORESTS	MATURE FORESTS
SUCCESSIONAL TRENDS	DOMINANTS	shrub dominated cover of: alder skunk cabbage lady fern moderate moss and liverwort cover	open coniferous forests of: western red cedar skunk cabbage lady fern moderate moss and liverwort cover	open coniferous forests of: western red cedar skunk cabbage lady fern moderate moss and liverwort cover
	ASSOCIATES	devil's-club Canadian bunchberry horsetails	spruce western hemlock devil's-club Canadian bunchberry horsetails oak fern	spruce western hemlock blueberries devil's-club Canadian bunchberry horsetails oak fern
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)	-	-	-
	MODERATE (5 to 20% cover)	twinberry honeysuckle blueberries	twinberry honeysuckle blueberries alpine fir	twinberry honeysuckle blueberries alpine fir
COMMENTS: tree establishment is slow after disturbance.				

WB Wetland bog vegetation landscape			ICHw
DESCRIPTION:		DOMINANT TYPE	ASSOCIATED TYPE
		depressional areas that receive most of its water from precipitation; usually acidic, organic substrate; permanently high water table	hummocky areas; usually acidic, organic substrate; permanently high water table
VEGETATION	DOMINANTS	glandular birch common Labrador tea sedges dense, thick cover of peat moss	open treed bog alpine fir lodgepole pine spruce glandular birch Labrador tea sedges peat moss
	ASSOCIATES	cotton-grass horsetails sundew marsh cinquefoil buckbean	hummocks with Pacific menziesia oval-leaved blueberry white-flowered rhododendron five-leaved creeping raspberry common moss
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)	glandular birch sedges	glandular birch sedges
	MODERATE (5 to 20% cover)	-	blueberries
COMMENTS: hardhack may surround these sites			

WF Wetland fen vegetation landscape complex			ICHw
DESCRIPTION:		DOMINANT TYPE	ASSOCIATED TYPE
		organic substrate; high water table; seasonally inundated; receives moisture and nutrients from upslope	organic substrate often with mineral material within 1 metre of the surface; high water table; seasonally inundated; receives moisture and nutrients from upslope
VEGETATION	DOMINANTS	sedge fen vegetation of: sedges Drepanocladus spp.	shrub-sedge vegetation of: willows glandular birch sedges buckbean bluejoint small reed grass Drepanocladus spp.
	ASSOCIATES	-	-
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)	sedges	willow glandular birch sedges
	MODERATE (5 to 20% cover)	-	-
COMMENTS: the sedge fen vegetation occurs on slightly wetter habitats, usually right at the bottom of depressions; these areas may slowly succeed to bogs.			

2.4 ICHv - WET CENTRAL MONTANE INTERIOR CEDAR-HEMLOCK SUBZONE

This subzone occurs mainly in valley bottoms at the upper end of most of the valleys in the northern part of the park. This includes the Clearwater River, north of Hobson Lake, Hobson Creek, Azure River, and upper Murtle River.

Environment

This subzone receives more precipitation, including higher snowfall, than all other subzones of the Interior Cedar-Hemlock Zone. Temperatures are generally cooler than other subzones. Within the park, this subzone is usually found on steep slopes.

Vegetation

Average sites have mature forests dominated by open to closed stands of western red cedar and western hemlock. The understory is typically composed of devil's-club, with a lush herb layer of oak fern, spiny shield fern, lady fern, unifoliate-leaved foam flower, Canadian bunchberry and blue-bead clintonia. The moss layer is moderate. After disturbance shrubs such as thimbleberry, alder and devil's-club dominate.

Snow avalanches are very common in this subzone and dominate the steep sloped areas. Vegetation is dominated by dense shrub communities of Sitka mountain alder, devil's-club, spiny shield fern, oak fern and lady fern.

Dry sites are uncommon in this subzone, but when present have forests dominated by western hemlock, Oregon boxwood, blueberries, Canadian bunchberry, blue-bead clintonia, oak fern and a dense moss layer.

Forage Potential

Forage potential for ungulates is limited within this subzone and as well, deep snow may prevent its utilization in winter.

The following two Vegetation Landscapes have been recognized for this subzone.

AS Sitka mountain alder - spiny shield fern vegetation landscape ICHv		
DESCRIPTION: steep sloped areas of avalanche chute; soil subject to seepage		
VEGETATION	DOMINANTS	dense shrub dominated, disturbance climax of: Sitka mountain alder spiny shield fern oak fern lady fern
	ASSOCIATES	black swamp gooseberry devil's-club simple-stemmed twistedstalk unifoliate-leaved foamflower
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)	-
	MODERATE (5 to 20% cover)	elder
COMMENTS: snow avalanches common in winter; damage from snow and competition prevent tree establishment on steep slopes; common in steeper valleys		

RD Western red cedar - devil's-club vegetation landscape (Plate 2.11)				ICHv
Description: generally lower slope positions that receive nutrient rich seepage from upslope; imperfectly drained sites of colluvial, morainal or fluvial materials				
		AFTER DISTURBANCE	YOUNG FORESTS	MATURE FORESTS
SUCCESSIONAL TRENDS	DOMINANTS	shrub dominated vegetation of: alder thimbleberry devil's-club lady fern oak fern spiny shield fern mosses	open to closed coniferous forests of: western red cedar devil's-club alder thimbleberry lady fern oak fern spiny shield fern mosses	closed to open coniferous stands of: western red cedar devil's-club lady fern oak fern spiny shield fern mosses
	ASSOCIATES	raspberry black swamp gooseberry unifoliate-leaved foamflower five-leaved creeping raspberry fireweed	spruce western hemlock alpine fir black swamp gooseberry unifoliate-leaved foamflower five-leaved creeping raspberry simple-stemmed twistedstalk	spruce western hemlock alder black swamp gooseberry unifoliate-leaved foamflower five-leaved creeping raspberry simple-stemmed twistedstalk
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)	-	-	-
	MODERATE (5 to 20% cover)	blueberries	blueberries alpine fir mountain-ash	blueberries alpine fir mountain-ash
COMMENTS: after disturbance a persistent dense shrub cover may inhibit tree establishment; slow rate of succession to dense forests				

2.5 ESSFm - MOIST CENTRAL ENGELMANN SPRUCE - SUBALPINE FIR SUBZONE

This subzone occurs throughout the park at higher elevations (above approximately 1200 m to 1350 m) and above the subzones of the Interior Cedar - Hemlock Zone.

Environment

This subzone is subject to high precipitation, including very deep snowfall. Precipitation tends to increase to the east and to the north. Temperatures and length of the growing season are lower than the Interior Cedar - Hemlock Zone.

Soils are deeply leached and are generally Podzols.

Vegetation

This subzone predominantly has open to closed forests. Average sites have mature forests dominated by closed stands of alpine fir and Engelmann spruce with a dense, shrub-dominated understory of white-flowered rhododendron, black blueberry, Pacific menziesia, unifoliate-leaved foamflower, oak fern, Sitka valerian, simple-stemmed twistedstalk and a dense moss cover. After disturbance a dense shrub-dominated community occurs with white-flowered rhododendron, black blueberry, willows, fireweed, Sitka valerian and broad-leaved arnica. At lower elevations of this landscape thimbleberry may be abundant. Seral forests are dominated by Engelmann spruce sometimes with lodgepole pine, and lesser amounts of alpine fir. The understory vegetation is similar to that of mature stands.

On dry, steep, southern exposures, mature forests are dominated by open to closed stands of alpine fir and Engelmann spruce with a moderate shrub layer of black blueberry and white-flowered rhododendron, and have Canadian bunchberry, five-leaved creeping raspberry and a moderate moss cover. After disturbance a shrub-herb cover of willows, black blueberry, fireweed and Canadian bunchberry occurs. Seral forests are dominated by Engelmann spruce, with lesser amounts of alpine fir, lodgepole pine and whitebark pine. Understory vegetation is similar to that of mature stands.

Wet, lower slope positions that receive nutrient-rich seepage from upslope have mature and seral forests dominated by open to closed forests of alpine fir and Engelmann spruce with an understory of devil's-club, lady fern, oak fern and a moderate moss cover. Western red cedar may occur. After disturbance a shrub dominated vegetation occurs, with thimbleberry, alder, devil's-club, lady fern, oak fern and fireweed.

Areas of cold air drainage in valley bottoms, have mature and seral forests dominated by closed stands of alpine fir with a sparse shrub layer and a dense herb layer of Sitka valerian, simple-stemmed twistedstalk, arrow-leaved ragwort and Brewer's mitrewort, and a moderate moss cover. After disturbance a herb dominated cover of Sitka valerian, arrow-leaved ragwort, fireweed and broad-leaved arnica occurs. This valley bottom vegetation is similar to average sites of the ESSFu - Wet, Central Upper Engelmann Spruce - Subalpine Fir Subzone.

Wetland vegetation is present but of limited extent and consists of fens dominated by sedges or willows.

Snow avalanches are common on steep slopes in this subzone and are dominated by Sitka mountain alder, devil's-club, spiny shield fern, oak fern and lady fern. Upper, gentle sloped areas of avalanche tracts have meadows of western meadow-rue, wild rye grass, western bracken, green false hellebore, Sitka valerian and arrow-leaved ragwort.

Forage Potential

Forage production is limited in this subzone and as well, the area is covered by deep snow in the winter. Upland sites have moderate amounts of willows after disturbance, moderate amounts of arboreal lichens in mature stands and during all successional stages, moderate amounts of blueberries, mountain-ash, twinberry honeysuckle, alpine fir and Oregon boxwood.

Wetlands have abundant sedges, and moderate amounts of willows and glandular birch. Avalanche areas may provide abundant forage for grizzly bears, and for summer use by ungulates.

The following six Vegetation Landscapes have been recognized within this subzone.

AS Sitka mountain alder - spiny shield fern vegetation landscape			ESSFm
DESCRIPTION:		DOMINANT TYPE	ASSOCIATED TYPE
		steep sloped area of avalanche chute; soil subject to seepage	upper, gentle slope area of avalanche chute; long snow duration; subalpine meadow
VEGETATION	DOMINANTS	dense shrub dominated disturbance climax of: Sitka mountain alder spiny shield fern oak fern lady fern	meadow vegetation of: western meadow-rue wild rye grass western bracken green false hellebore Sitka valerian
	ASSOCIATES	black swamp gooseberry devil's-club simple-stemmed twistedstalk unifoliate-leaved foamflower	fireweed arctic lupine fescues arrow-leaved ragwort Columbia lily subalpine fleabane cow-parsnip
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)		
	MODERATE (5 to 20% cover)	elder black swamp gooseberry	fescues alpine timothy sedges mountain-ash
COMMENTS: snow avalanches common in winter; damage from snow and competition prevent tree establishment on steep slopes; long snow duration prevents tree establishment in upper, meadow areas			

FB Alpine fir - black blueberry vegetation landscape				ESSFm
Description: steep southeast to west facing slopes; deep to shallow (less than 1m), well to moderately well drained soils of morainal and colluvial material; high amount of solar radiation.				
		AFTER DISTURBANCE	YOUNG FORESTS	MATURE FORESTS
SUCCESSIONAL TRENDS	DOMINANTS	shrub-herb cover of: willows black blueberry fireweed	open forests of: Engelmann spruce alpine fir black blueberry white-flowered rhododendron five-leaved creeping raspberry	closed forests of: alpine fir Engelmann spruce black blueberry white-flowered rhododendron five-leaved creeping raspberry moderate moss cover
	ASSOCIATES	white-flowered rhododendron Sitka mountain alder Oregon boxwood oak fern Sitka valerian mountain vahlodea Canadian bunchberry	whitebark pine lodgepole pine Oregon boxwood Pacific menziesia oak fern Sitka valerian mountain vahlodea Canadian bunchberry	Pacific menziesia oak fern Sitka valerian simple-stemmed twistedstalk mountain vahlodea Canadian bunchberry
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)	black blueberry	black blueberry	black blueberry
	MODERATE (5 to 20% cover)	Oregon boxwood alpine fir mountain-ash	Oregon boxwood alpine fir mountain-ash	alpine fir arboreal lichens
COMMENTS: slow rate of succession; arctic lupine, birch-leaved spirea, common juniper, saskatoon and Oregon boxwood may be common at lower elevations particularly on sites with shallow soils; rhododendron is often dominant, but may be absent or sparse; lichens may be common in areas with shallow soils; these sites are usually sensitive to disturbance particularly on steep slopes and shallow soils; luetkea, mountain-heather and Merten's cassiope may occur at higher elevations				

FD Alpine fir - devil's-club vegetation landscape				ESSFm
Description: lower elevations of this zone; lower slope positions that receive nutrient rich seepage from upslope; imperfectly drained soils of colluvial, morainal or fluvial materials				
		AFTER DISTURBANCE	YOUNG FORESTS	MATURE FORESTS
SUCCESSIONAL TRENDS	DOMINANTS	shrub dominated vegetation of: thimbleberry alder devil's-club lady fern oak fern fireweed	open to closed forests of: alpine fir Engelmann spruce devil's-club lady fern oak fern	open to closed forests of: alpine fir Engelmann spruce devil's-club lady fern oak fern moderate moss cover
	ASSOCIATES	raspberry black blueberry black swamp gooseberry Sitka valerian unifoliate-leaved foamflower five-leaved creeping raspberry	black blueberry black swamp gooseberry Sitka valerian unifoliate-leaved foamflower simple-stemmed twistedstalk five-leaved creeping raspberry	black blueberry black swamp gooseberry Sitka valerian unifoliate-leaved foamflower simple-stemmed twistedstalk five-leaved creeping raspberry
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)	-	-	-
	MODERATE (5 to 20% cover)	blueberries	blueberries	blueberries arboreal lichens
COMMENTS: western red cedar may occur at lower elevations of this landscape; slow succession towards forested stages; dense shrub layer may inhibit tree establishment				

FR Alpine fir- white-flowered rhododendron vegetation landscape (Plate 2.12)				ESSFm
Description: mesic (average) sites for this subzone; well to moderately well drained soils of deep colluvial, morainal or fluvial material on moderate to moderately steep slopes; good moisture availability				
		AFTER DISTURBANCE	YOUNG FORESTS	MATURE FORESTS
SUCCESSIONAL TRENDS	DOMINANTS	shrub-herb cover of: white-flowered rhododendron black blueberry willows fireweed Sitka valerian broad-leaved arnica	closed coniferous forests of: Engelmann spruce alpine fir with a dense shrub cover of white-flowered rhododendron black blueberry oak fern Sitka valerian unifoliate-leaved foamflower moderate moss cover	closed coniferous forests of: alpine fir Engelmann spruce with a dense cover of white-flowered rhododendron black blueberry unifoliate-leaved foamflower oak fern Sitka valerian dense moss cover
	ASSOCIATES	thimbleberry Sitka mountain alder raspberry oak fern simple-stemmed twistedstalk five-leaved creeping raspberry pearly everlasting	lodgepole pine black swamp gooseberry Pacific menziesia simple-stemmed twistedstalk five-leaved creeping raspberry broad-leaved arnica Canadian bunchberry	oval-leaved blueberry black swamp gooseberry Pacific menziesia simple-stemmed twistedstalk five-leaved creeping raspberry broad-leaved arnica Canadian bunchberry
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)	blueberries	blueberries alpine fir	alpine fir
	MODERATE (5 to 20% cover)	mountain-ash twinberry honeysuckle willows	mountain-ash arboreal lichens twinberry honeysuckle alpine fir	arboreal lichens mountain-ash blueberries twinberry honeysuckle
COMMENTS: at upper elevations of this landscape, succession to forests and tree establishment are very slow; at lower elevations of this subzone thimbleberry, raspberry, arctic lupine and Oregon boxwood may be common in earlier stages; may occur on volcanic material				

Plate 2.12 Mature understory vegetation of the Alpine fir - white-flowered rhododendron vegetation landscape (FR). This site has open forests of alpine fir and Engelmann spruce with a shrub-dominated understory of white-flowered rhododendron, blueberries, Pacific menziesia, oak fern, five-leaved creeping raspberry and mosses. This site has moderately well drained soils developed on morainal material on a moderate slope.

FT Alpine fir - Simple-stemmed twistedstalk				ESSFm
Description: found in areas that have cold air drainage; generally in broad valleys; deep, well to imperfectly drained soils of morainal or fluvial materials				
		AFTER DISTURBANCE	YOUNG FORESTS	MATURE FORESTS
SUCCESSIONAL TRENDS	DOMINANTS	herb dominated cover of: Sitka valerian arrow-leaved ragwort fireweed broad-leaved arnica	coniferous forests of: alpine fir Engelmann spruce with a dense herb cover of Sitka valerian simple-stemmed twistedstalk arrow-leaved ragwort Brewer's mitrewort	open to closed coniferous forests of: alpine fir Engelmann spruce with a dense herb cover of Sitka valerian simple-stemmed twistedstalk arrow-leaved ragwort Brewer's mitrewort moderate moss cover
	ASSOCIATES	black blueberry white-flowered rhododendron five-leaved creeping raspberry unifoliate-leaved foamflower western meadow-rue simple-stemmed twistedstalk	sparse cover of: black blueberry white-flowered rhododendron broad-leaved arnica green false hellebore five-leaved creeping raspberry unifoliate-leaved foamflower western meadow-rue	sparse shrub cover of: black blueberry white-flowered rhododendron broad-leaved arnica green false hellebore five-leaved creeping raspberry unifoliate-leaved foamflower western meadow-rue
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)	-	-	-
	MODERATE (5 to 20% cover)	alpine fir blueberries willows twinberry honeysuckle	arboreal lichens blueberries alpine fir twinberry honeysuckle	blueberries alpine fir twinberry honeysuckle arboreal lichens
COMMENTS: low forage production; slow rate of succession as tree establishment and tree growth is slow; lodgepole pine may be common in seral forests; common in the Steven's Lake area				

WF Wetland fen vegetation landscape complex				ESSFm
DESCRIPTION:		DOMINANT TYPE	ASSOCIATED TYPE	ASSOCIATED TYPE
		organic substrate; high water table; seasonally inundated; receives moisture and nutrients from upslope	organic substrate often with mineral material within 1 metre of the surface; high water table; seasonally inundated; receives moisture and nutrients from upslope	depressional areas that receive most of its water from precipitation; usually acidic, organic substrate; permanently high water table
VEGETATION	DOMINANTS	sedge fen vegetation of: sedges Drepanocladus spp.	shrub-sedge fen vegetation of: willows glandular birch sedges bluejoint small reed grass Drepanocladus spp.	shrub-sedge-moss bog of: glandular birch common Labrador tea sedges dense, thick cover of peat moss
	ASSOCIATES	-	-	cotton-grass horsetails sundew marsh cinquefoil
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)	sedges	willow glandular birch sedges	glandular birch sedges
	MODERATE (5 to 20% cover)	-	-	-
COMMENTS: the sedge fen vegetation occurs on slightly wetter habitats, usually at the bottom of depressions; these areas may be surrounded by bog vegetation and may slowly succeed to bogs				

The following six Vegetation Landscapes have been recognized within this subzone.

2.6 ESSFu - WET. CENTRAL, UPPER ENGELMANN SPRUCE - SUBALPINE FIR SUBZONE

This subzone occurs as a narrow, discontinuous band above the ESSFm subzone, throughout the park.

Environment

This subzone is subjected to very high precipitation, including high snowfall, with long snow duration. Temperatures are less than lower elevation subzones and the growing season is shorter.

Soils are deeply leached and are usually Sombric Podzols.

Vegetation

Open to closed forests dominate. Meadow communities similar to those found in the Parkland subzone (ESSFmp) may occur here. Average sites have mature and seral forests dominated by open to closed canopy of alpine fir and Engelmann spruce with a sparse shrub cover and a lush herb layer of Sitka valerian, simple-stemmed twistedstalk, arrow-leaved ragwort, Brewer's mitrewort, broad-leaved arnica and a moderate moss cover. Mature stands have a moderate to abundant arboreal lichen cover. After disturbance a herb dominated cover of Sitka valerian, arrow-leaved ragwort, fireweed and broad-leaved arnica occurs. Tree invasion after disturbance and tree growth is very slow.

Snow avalanche areas are common. Steep sloped sites have vegetation dominated by Sitka mountain alder, spiny shield fern, oak fern, and lady fern. Upper, gentle sloped areas of avalanche tracts have meadows of western meadow-rue, wild rye grass, green false hellebore, Sitka valerian and arrow-leaved ragwort.

Forage Potential

Forage potential is very low in this subzone except, for moderate to abundant arboreal lichens in mature forests. Other plants are under deep snow in winter. Avalanche areas may provide abundant forage for grizzly bears.

The following three Vegetation Landscapes have been recognized for this subzone.

AS Sitka mountain alder - spiny shield fern vegetation landscape			ESSFu
		DOMINANT TYPE	ASSOCIATED TYPE
DESCRIPTION:		steep sloped area of avalanche chute; soil subject to seepage	upper, gentle slope area of avalanche chute; long snow duration; subalpine meadow
VEGETATION	DOMINANTS	dense shrub dominated disturbance climax of: Sitka mountain alder spiny shield fern oak fern lady fern	meadow vegetation of: western meadow-rue wild rye grass western bracken green false hellebore Sitka valerian
	ASSOCIATES	black swamp gooseberry simple-stemmed twistedstalk unifoliate-leaved foamflower	fireweed arctic lupine fescues arrow-leaved ragwort Columbia lily subalpine fleabane cow-parsnip
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)		
	MODERATE (5 to 20% cover)	black swamp gooseberry	fescues alpine timothy sedges mountain-ash
COMMENTS: snow avalanches common in winter; damage from snow and competition prevent tree establishment on steep slopes; long snow duration prevents tree establishment in upper, meadow areas			

FA Alpine fir - broad-leaved arnica vegetation landscape				ESSFu
Description: dry sites for this subzone; well drained soils of deep to shallow (less than 1m) colluvial and morainal material on steep to moderately steep slopes.				
		AFTER DISTURBANCE	YOUNG FORESTS	MATURE FORESTS
SUCCESSIONAL TRENDS	DOMINANTS	shrub-herb cover of: white-flowered rhododendron black blueberry willows fireweed Sitka valerian broad-leaved arnica	closed coniferous forests of: Engelmann spruce alpine fir with a dense shrub cover of white-flowered rhododendron black blueberry broad-leaved arnica Sitka valerian moderate bryophyte cover	closed coniferous forests of: alpine fir Engelmann spruce with a dense cover of white-flowered rhododendron black blueberry broad-leaved arnica Sitka valerian moderate bryophyte cover
	ASSOCIATES	Sitka mountain alder luetkea five-leaved creeping raspberry	black swamp gooseberry simple-stemmed twistedstalk five-leaved creeping raspberry luetka	oval-leaved blueberry black swamp gooseberry simple-stemmed twistedstalk five-leaved creeping raspberry broad-leaved arnica luetkea
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)	blueberries	blueberries alpine fir	alpine fir arboreal lichens
	MODERATE (5 to 20% cover)	willows	arboreal lichens	blueberries
COMMENTS: succession to forests and tree establishment are very slow.				

FV alpine fir - Sitka valerian vegetation landscape (Figure 2.13)				ESSFu
Description: average sites for this subzone; found on deep, well to imperfectly drained soils of morainal or colluvial material; usually podzols often with a thick humus layer on top				
		AFTER DISTURBANCE	YOUNG FORESTS	MATURE FORESTS
SUCCESSIONAL TRENDS	DOMINANTS	herb dominated cover of: Sitka valerian arrow-leaved ragwort fireweed broad-leaved arnica	coniferous forests of: alpine fir Engelmann spruce with a dense herb cover of Sitka valerian simple-stemmed twistedstalk arrow-leaved ragwort Brewer's mitrewort	closed coniferous forests of: alpine fir Engelmann spruce with a dense herb cover of Sitka valerian simple-stemmed twistedstalk arrow-leaved ragwort Brewer's mitrewort arboreal lichens moderate moss cover
	ASSOCIATES	black blueberry white-flowered rhododendron five-leaved creeping raspberry unifoliate-leaved foamflower western meadow-rue simple-stemmed twistedstalk	sparse cover of: black blueberry white-flowered rhododendron broad-leaved arnica green false hellebore five-leaved creeping raspberry unifoliate-leaved foamflower western meadow-rue	sparse shrub cover of: black blueberry white-flowered rhododendron broad-leaved arnica green false hellebore five-leaved creeping raspberry unifoliate-leaved foamflower western meadow-rue
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)	-	-	arboreal lichens
	MODERATE (5 to 20% cover)	alpine fir blueberries willows	arboreal lichens blueberries alpine fir	blueberries alpine fir
COMMENTS: low forage production except arboreal lichens are common in later stages; slow rate of succession as tree establishment and tree growth is slow;				

Plate 2.13 Mature vegetation of the Alpine fir - Sitka valerian vegetation landscape (FV). This site has a closed forest of alpine fir and Engelmann spruce with a herb dominated understory of Sitka valerian, simple-stemmed twistedstalk, unifoliate-leaved foamflower, broad-leaved arnica, Brewer's mitrewort and mosses. Arboreal lichens are moderate to abundant on these sites. This site has deep, moderately well drained soils which are developed on morainal material.

2.7 ESSFmp - ENGELMANN SPRUCE - SUBALPINE FIR, PARKLAND SUBZONE

This subzone occurs as a narrow, discontinuous band below the Alpine Tundra Zone (AT).

Environment

This subzone is subjected to very high precipitation, including high snowfall with long snow duration. Temperatures are cooler than lower elevation subzones and the growing season is very short.

Soils are deeply leached, often with a thick litter layer due to slow decomposition. The soils are usually Sombric Podzols.

Vegetation

Parkland forests, intermixed with meadows, dominate this subzone. Due to the long snow duration, trees grow on elevated areas where snow leaves first in the spring. Depressional areas have longer snow duration and support various kinds of meadows.

The parkland forests are dominated by alpine fir, Engelmann spruce, black blueberry, Merten's cassiope, pink mountain-heather, luetkea, Sitka valerian, moderate to abundant arboreal lichens and a moderate to dense moss cover. Tree invasion after disturbance and tree growth is very slow.

Many different communities of subalpine meadows occur in Wells Gray Park. Meadows in the southern part of the park are described in more detail by Hamet-Ahti (1978). Major differences in species composition occurs, dependent on moisture availability. Drier meadows may be dominated by dwarf blueberry, woolly pussytoes, subalpine fleabane, sedges, boreal mugwort, creeping sibbaldia, mountain vahlodea and spike trisetum. Moist meadows are lush with subalpine fleabane, Sitka valerian, sedges, arrow-leaved ragwort, mountain vahlodea, arctic lupine and dwarf blueberry. Wet, sedge meadows occur in low-lying areas and along with sedges, have abundant moss cover with lesser amounts of forbs.

Wetland vegetation occurs along creeks and consists of willow, sedges and peat moss with lesser amounts of cotton-grass, marsh cinquefoil, bluejoint small reed grass and leatherleaf saxifrage. Other meadow and wetland communities may occur in this subzone.

Forage Potential

Winter forage potential is limited to moderate to abundant arboreal lichens in the tree islands. Shrubs, forbs and graminoids are under deep snow in winter. Meadows provide abundant summer forage for ungulates and grizzly bears.

The following six Vegetation Landscapes have been recognized for this subzone.

<table>
<tr><td colspan="2">BP Dwarf blueberry - woolly pussytoes vegetation landscape</td><td>ESSFmp</td></tr>
<tr><td colspan="2">Description: low ridges and dry gentle slopes; long snow duration; deep to shallow (less than 1m) soils of morainal or fluvial material; thich humus in soil; turfy top on soil</td><td></td></tr>
<tr><td rowspan="2">VEGETATION</td><td>DOMINANTS</td><td>forb-graminoid meadow of:
dwarf blueberry
woolly pussytoes
subalpine fleabane
sedges
moderate moss and lichen cover</td></tr>
<tr><td>ASSOCIATES</td><td>boreal mugwort
creeping sibbaldia
mountain vahlodea
spike trisetum
California oat grass</td></tr>
<tr><td rowspan="2">WINTER FORAGE POTENTIAL FOR WILD UNGULATES</td><td>ABUNDANT (above 20% cover)</td><td>-</td></tr>
<tr><td>MODERATE (5 to 20% cover)</td><td>sedges
grasses</td></tr>
<tr><td colspan="3">COMMENTS: common in Battle Mountain - Caribou Meadows area; rare tree present; tree establishment may be inhibited by turfy top of soil, cold air drainage or long snow duration</td></tr>
</table>

FL Alpine fir - luetkea vegetation landscape (Figure 2.14)				ESSFmp
Description: usually on shallow (less than 1m), rapidly to moderately well drained soils of colluvial and morainal material; may occur on deep soils; averate sites for this subzone.				
		AFTER DISTURBANCE	YOUNG FORESTS	MATURE FORESTS
SUCCESSIONAL TRENDS	DOMINANTS	dwarf shrub-herb cover of: Merten's cassiope pink mountain-heather luetkea Sitka valerian fireweed	parkland forests of: alpine fir black blueberry Merten's cassiope pink mountain-heather luetkea Sitka valerian	parkland forests of: alpine fir black blueberry Merten's cassiope pink mountain-heather luetkea Sitka valerian arboreal lichens moderate to dense moss cover
	ASSOCIATES	black blueberry white-flowered rhododendron broad-leaved arnica sedges mountain vahlodea	Engelmann spruce white-flowered rhododendron broad-leaved arnica wood-rush Brewer's mitrewort sedges mountain vahlodea dwarf blueberry	Engelmann spruce white-flowered rhododendron broad-leaved arnica wood-rush Brewer's mitrewort sedges mountain vahlodea
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)	-	-	arboreal lichens
	MODERATE (5 to 20% cover)	mountain-ash sedges black blueberry	mountain-ash arboreal lichens sedges black blueberry	mountain-ash sedges black blueberry
COMMENTS: this landscape is often intermixed with sedge or forb meadows; arboreal lichens are moderate to abundant; areas of deep snowfall; slow tree growth; slow tree establishment after disturbance; whitebark pine may occur; shrubs may occur surrounding tree islands				

GS Yellow glacier lily - western spring beauty vegetation landscape (Plate 2.15)		ESSFmp
Description: areas of long snow duration provide moisture much of growing season; deep or shallow (less than 1m), moderately well drained soils of colluvial or morainal material; thich humus layer on top of soil		
VEGETATION	DOMINANTS	forb meadow of: yellow glacier lily western spring beauty sedges subalpine fleabane Sitka valerian
	ASSOCIATES	western anemone Brewer's mitrewort arctic lupine pussytoes arrow-leaved ragwort western meadow-rue
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)	sedges
	MODERATE (5 to 20% cover)	-
COMMENTS: attractive flower meadows; found on Trophy Mountain, Table Mountain and Mt. Ray		

Plate 2.14 Mature vegetation of the Alpine fir - luetkea vegetation landscape (FL). This site has a parkland forest dominated by alpine fir with an understory of black blueberry, Merten's cassiope, luetkea, broad-leaved arnica and pink mountain-heather. This site is found on shallow, moderately well drained soil developed on colluvial material. This landscape is often intermixed with meadow vegetation. It usually has moderate to abundant arboreal lichens present.

Plate 2.15 Vegetation of the Yellow glacier lily - western spring beauty vegetation landscape (GS), dominated by yellow glacier lily, western spring beauty, subalpine fleabane, sedges and Sitka valerian. This meadow vegetation occurs on moist areas of deep snow accumulation. This site has soils developed from shallow, colluvial material. This landscape also occurs in the Alpine tundra zone.

SM Sedge - moss vegetation landscape		ESSFmp
Description:	wet, depressional areas with long snow duration; deep imperfectly to poorly drained soils of morainal or fluvial material	
VEGETATION	DOMINANTS	sedge meadow vegetation of: sedges moss
	ASSOCIATES	mountain vahlodea subalpine feabane arrow-leaved ragwort dwarf blueberry bluejoint small reed grass white marsh-marigold
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)	sedges
	MODERATE (5 to 20% cover)	-
COMMENTS:	the species of sedges changes as the site gets wetter; wetter areas have deeper organic material, particularly along creeks	

SP	Sedge - peat moss vegetation landscape	ESSFmp
Description:	depressional areas that receive most of its water from precipitation; usually acidic, shallow to deep organic substrate; permanently high water table	
VEGETATION	DOMINANTS	wetland vegetation of: willow sedges dense, thick cover of peat moss
	ASSOCIATES	cotton-grass marsh cinquefoil bluejoint small reed grass leatherleaf saxifrage
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)	sedges
	MODERATE (5 to 20% cover)	willows glandular birch
COMMENTS:	willows may surround these areas	

VF Sitka valerian - subalpine fleabane vegetation landscape ESSFmp		
Description: intermixed among parkland forests; long snow duration; gently sloped areas with deep, moderately well to imperfectly drained soils of morainal or fluvial materials; thick humus layer		
VEGETATION	DOMINANTS	lush forb meadow of: subalpine fleabane Sitka valerian sedges arrow-leaved ragwort moderate moss cover
	ASSOCIATES	mountain vahlodea arctic lupine dwarf blueberry boreal mugwort orange false dandelion
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)	sedges
	MODERATE (5 to 20% cover)	-
COMMENTS: white marsh-marigold, white globeflower and black alpine sedge are more common on wetter sites of this landscape; common in Battle Mountain area		

2.8 ATe - MOIST, ALPINE TUNDRA SUBZONE

This subzone occurs at upper elevations, throughout the park.

Environment

These areas are subjected to very harsh conditions. This subzone receives high precipitation including high snowfall. Snow distribution is quite variable due to strong winds which create areas with little snow and other areas with deep accumulations from snow drift. Temperatures are low and the growing season is very short. Soils are quite variable. Much of this area is dominated by rock, with little soil present, and glaciers are common in the northern parts of this subzone.

Vegetation

Much of this subzone is dominated by sparsely vegetated rock with grasses, sedges and forbs growing in small pockets of soil or in cracks of rocks. At lower elevations a narrow band of krummholz tree islands occurs. This vegetation is dominated by alpine fir, pink mountain-heather, Merten's cassiope, luetkea and sedges.

Two meadow communities have been recognized. Attractive, moist meadows, found mainly in southern parts of the park are dominated by yellow glacier lily, western spring beauty, sedges, subalpine fleabane, Sitka valerian and western anemone. In northern parts of the park, wet meadows dominated by sedges with lesser cover of wood-rush, western anemone, rushes and alpine timothy, become prominent.

Forage Potential

Forage availability is best in wet meadows, however in winter these areas are generally under deep snow. Drier, windswept areas are sparsely vegetated by grasses and sedges, providing limited forage. Meadows provide summer forage for ungulates and grizzly bears.

The following three Vegetation Landscapes have been recognized for this subzone. Other plant communities may occur.

FC Alpine fir - Merten's cassiope vegetation landscape (Plate 2.16) ATe		
Description:	low elevation areas of Alpine Tundra zone; usually on well to rapidly drained, shallow soils (less than 1m) of morainal or colluvial materials; windswept areas	
VEGETATION	DOMINANTS	krummholz islands of: alpine fir pink mountain-heather Merten's cassiope luetkea sedges
	ASSOCIATES	willows mountain vahlodea pussytoes Sitka valerian wood-rush subalpine fleabane western anemone boreal mugwort
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)	-
	MODERATE (5 to 20% cover)	willows blue grass sedges
COMMENTS: whitebark pine may occur; alpine fir may be absent or uncommon		

Plate 2.16 Vegetation of the Alpine fir - Merten's cassiope vegetation landscape (FC), dominated by low clumps of alpine fir, Merten's cassiope, pink mountain-heather, sedges, wood-rush, Sitka valerian, luetkea, western anemone and arrow-leaved ragwort. This site has deep, moderately well drained soils developed from morainal material.

Plate 2.17 Vegetation of the Sedge - wood-rush vegetation landscape (SW), dominated by sedges, wood-rush, rushes, western anemone, sticky purple crane's-bill, subalpine fleabane, arrow-leaved ragwort, Sitka valerian, luetkea and a dense moss cover. This lush meadow vegetation occur on moist areas of deep snow accumulation. This site has deep, imperfectly drained soils with a thick humus layer, developed on morainal material.

GS Yellow glacier lily - western spring beauty vegetation landscape ATe		
Description: areas of long snow duration provide moisture much of growing season; deep or shallow (less than 1m), moderately well drained soils of colluvial and morainal material; thick humus layer on top of soil		
VEGETATION	DOMINANTS	alpine forb meadow of: yellow glacier lily western spring beauty sedges subalpine fleabane Sitka valerian
	ASSOCIATES	western anemone Brewer's mitrewort arctic lupine pussytoes arrow-leaved ragwort western meadow-rue
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)	sedges
	MODERATE (5 to 20% cover)	-
COMMENTS: attractive flower meadows; found on Trophy Mountain, Table Mountain and Mt. Ray		

SW	Sedge - wood-rush vegetation landscape (Plate 2.17)	ATe
Description:	long snow duration; wet meadow areas; moderately well to imperfectly drained, deep soils of morainal or colluvial materials	
VEGETATION	DOMINANTS	alpine sedge meadow of: dense cover of sedges wood-rush rushes western anemone moderate moss cover
	ASSOCIATES	alpine timothy creeping sibbaldia subalpine fleabane Sitka valerian luetkea blue grass
WINTER FORAGE POTENTIAL FOR WILD UNGULATES	ABUNDANT (above 20% cover)	sedges
	MODERATE (5 to 20% cover)	grasses
COMMENTS:	common in northern areas of the park which are subject to high snowfall; rare alpine fir present; leatherleaf saxifrage and sticky purple crane's bill may be present	

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APPENDIX A
PLANT SPECIES LIST[1]

COMMON NAME	BOTANICAL NAME
alder	Alnus spp.
alpine fir	Abies lasiocarpa
alpine timothy	Phleum alpinum
arboreal lichens	Alectoria spp., Bryoria spp.
arctic lupine	Lupinus arcticus
arrow-leaved ragwort	Senecio triangularis
asters	Aster spp.
bent grass	Agrostis spp.
birch-leaved spirea	Spiraea betulifolia
black alpine sedge	Carex nigricans
black blueberry	Vaccinium membranaceum
black cottonwood	Populus balsamifera subsp. trichocarpa
black swamp gooseberry	Ribes lacustre
blue-bead clintonia	Clintonia uniflora
blueberries	Vaccinium spp.
bluebunch wheat grass	Agropyron spicatum
blue grass	Poa spp.
bluejoint small reed grass	Calamagrostis canadensis
boreal mugwort	Artemisia arctica
Brewer's mitrewort	Mitella breweri
bristly Nootka rose	Rosa nutkana
broad-leaved arnica	Arnica latifolia
buckbean	Menyanthes trifoliata
California oat grass	Danthonia californica
Canadian bunchberry	Cornus canadensis
ceanothus	Ceanothus spp.
cherry	Prunus spp.
choke cherry	Prunus virginiana
Columbia lily	Lilium columbianum
common juniper	Juniperus communis
common Labrador tea	Ledum groenlandicum
common moss	Pleurozium schreberi
common pink pyrola	Pyrola asarifolia
common snowberry	Symphoricarpos albus
common western pipsissiwa	Chimaphila umbellata
cotton-grass	Eriophorum spp.
cow-parsnip	Heracleum sphondylium
creeping sibbaldia	Sibbaldia procumbens

[1]Common and botanical names of vascular plants follow Taylor and MacBryde (1977). This list covers those plants mentioned in the report.

APPENDIX A (CONTINUED)

COMMON NAME	BOTANICAL NAME
devil's-club	Oplopanax horridus
Douglas-fir	Pseudotsuga menziesii
-	Drepanocladus spp.
dwarf blueberry	Vaccinium caespitosum
elder	Sambucus spp.
Engelmann spruce	Picea engelmannii
fescues	Festuca spp.
filbert	Corylus cornuta
fireweed	Epilobium angustifolium
five-leaved creeping raspberry	Rubus pedatus
glandular birch	Betula glandulosa
green false hellebore	Veratrum viride
hardhack	Spiraea douglasii
hawthorn	Crataegus spp.
high bush cranberry	Viburnum edule
horsetails	Equisetum spp.
hybrid spruce	Picea glauca X engelmannii
juniper	Juniperus spp.
kinnikinnick	Arctostaphylos uva-ursi
lady fern	Athyrium filix-femina
layered moss	Hylocomium splendens
leatherleaf saxifrage	Leptarrhena pyrolifolia
Lindley's aster	Aster ciliolatus
lodgepole pine	Pinus contorta
luetkea	Luetkea pectinata
marsh cinquefoil	Potentilla palustre
Merten's cassiope	Cassiope mertensiana
moss	
common low to medium elevation mosses	include:
	Pleurozium schreberi
	Dicranum spp.
	Rhytidiopsus robusta
	Ptilium crista-castrensis
	Hylocomium splendens

APPENDIX A (CONTINUED)

COMMON NAME	BOTANICAL NAME
common high elevation bryophytes include:	
	Brachythecium spp.
	Barbilophozia spp.
common wetland mosses include:	
	Sphagnum spp.
	Drepanocladus spp.
	Aulacomnium spp.
mountain-ash	Sorbus scopulina or S. sitchensis
mountain-heather	Phyllodoce spp.
mountain vahlodea	Vahlodea atropurpurea
northern twinflower	Linnaea borealis
oak fern	Gymnocarpium dryopteris
orange false dandelion	Agoseris aurantiaca
Oregon boxwood	Paxistima myrsinites
Oregon-grape	Mahonia spp. (mainly M. aquifolium)
oval-leaved blueberry	Vaccinium ovalifolium
Pacific menziesia	Menziesia ferruginea
palmate colt's-foot	Petasites palmatus
paper birch	Betula papyrifera
pearly everlasting	Anaphales margaritacea
peat mosses	Sphagnum spp.
pin cherry	Prunus pensylvanica
pine grass	Calamagrostis rubescens
pink mountain-heather	Phyllodoce empetriformis
pussytoes	Antennaria spp.
pyrola	Pyrola spp.
raspberry	Rubus idaeus
red-osier dogwood	Cornus sericea
redstem ceanothus	Ceanothus sanguineus
Rocky Mountain juniper	Juniperus scopulorum
Rocky Mountain maple	Acer glabrum
roses	Rosa spp.
rough-fruited fairybells	Disporum trachycarpum
rushes	Juncus spp.

APPENDIX A (CONTINUED)

COMMON NAME	BOTANICAL NAME
saskatoon	Amelanchier alnifolia
Scouler's willow	Salix scouleriana
sedges	Carex spp.
showy aster	Aster conspicuus
shrubby penstemon	Penstemon fruticosus
simple-stemmed twistedstalk	Streptopus roseus
Sitka mountain alder	Alnus viridis subsp. sinuata
Sitka valerian	Valeriana sitchensis
skunk cabbage	Lysichiton americanum
snowberry	Symphoricarpos albus
snowbush ceanothus	Ceanothus velutinus
soopolallie	Shepherdia canadensis
spreading dogbane	Apocynum androsaemifolium
spike trisetum	Trisetum spicatum
spiny shield fern	Dryopteris assimilis
spruce	Picea spp.
sticky purple crane's-bill	Geranium viscosissimum
stinging nettle	Urtica dioica
subalpine fleabane	Erigeron peregrinus
subalpine fir	Abies lasiocarpa
sundew	Drosera spp. (D. rotundifolia and D. anglica)
thimbleberry	Rubus parviflorus
thin-leaved mountain alder	Alnus incana subsp. tenuifolia
trembling aspen	Populus tremuloides
twinberry honeysuckle	Lonicera involucrata
unifoliate-leaved foamflower	Tiarella unifoliata
western anemone	Pulsatilla occidentalis
western bracken	Pteridium aquilinum
western hemlock	Tsuga heterophylla
western meadow-rue	Thalictrum occidentale
western red cedar	Thuja plicata
western spring beauty	Claytonia lanceolata
western white pine	Pinus monticola
western yew	Taxus brevifolia
whitebark pine	Pinus albicaulis
white-flowered rhododendron	Rhododendron albiflorum
white globeflower	Trollius laxus
white marsh-marigold	Caltha leptosepala

APPENDIX A (CONTINUED)

COMMON NAME	BOTANICAL NAME
wild rye grass	Elymus spp.
wild sarsaparilla	Aralia nudicaulis
willows	Salix spp. (mainly S. scouleriana on upland sites)
woolly pussytoes	Antennaria lanata
wood-rush	Luzula spp.

APPENDIX B

POTENTIAL AVAILABILITY OF KEY WINTER FORAGE SPECIES AFTER CLEARING AND FIRE, FOR VEGETATION LANDSCAPES WITHIN THE ICHe and ICHm SUBZONES

SUBZONE	VEGETATION LANDSCAPE	WILLOWS		PAPER BIRCH		OREGON BOXWOOD		RED-OSIER DOGWOOD		SNOWBUSH CEANOTHUS	
		C[1]	F	C	F	C	F	C	F	C	F
ICHe	CD	A[2]	A	N	N	N	N	A	A	N	N
	DA	L	M	L	L	L	L	N	N	L	M
	DJ	N-L	N-L	N	N	L	L	N	N	N	L
	RB	M	M-A	M-A	M-A	A	A	L-M	L-M	N	N
	RD	L	L	N	N	N	N	L	L	N	N
ICHm	AK	L	L	L	L	L	L	N	N	N	L
	BB	M	M-A	L-M	M-A	M-A	M-A	L-M	L-M	N	N
	BD	M	M-H	M-A	M-A	M	M	M-A	M-A	N	N
	BF	M	M	L-M	M-A	M-A	M-A	L-M	L-M	N	N
	CD	A	A	N	N	N	N	A	A	N	N
	DC	L-M	M	L-M	L-M	L-M	L-M	N	N	L	M-A
	DS	L-M	L-M	L	L	M	M	N	N	L	M
	HB	M	M-A	L	L	M	M	L	L	N	N
	PB	L-M	M	L	L	M-H	M-H	N	N	N	L-M
	RD	L	L	N	N	N	N	L	L	N	N
	RS	L	L	N	N	N	N	L	L	N	N
	WB	N	N	N	N	N	N	N	N	N	N
	WF	L-A	L-A	N	N	N	N	N	N	N	N
	WS	L-M	L-M	N	N	N	N	N	M	N	N

[1] C - after clearing; F - after fire.

[2] Abundance Ratings: N - none, L - low, M - moderate, A - abundant.

APPENDIX B (CONTINUED)

SUBZONE	VEGETATION LANDSCAPE	REDSTEM CEANOTHUS		SASKATOON		ALPINE FIR		ROCKY MTN. MAPLE		BLACK COTTONWOOD	
		C[1]	F	C	F	C	F	C	F	C	F
ICHe	CD	N[2]	N	N	N	N	N	N	N	A	A
	DA	L	M-A	M	M	N	N	M	M	N	N
	DJ	N	L	L-M	L-M	N	N	L	L	N	N
	RB	N	N	L-M	L-M	L-M	L-M	L-M	L-M	N	N
	RD	N	N	N	N	L-M	L-M	N	N	N	N
ICHm	AK	N	L-M	M	M	N	N	L-M	L-M	N	N
	BB	N	N	L-M	L-M	L-M	L-M	L-M	L-M	N	N
	BD	N	N	L-M	L-M	L	L	L-M	L-M	N	N
	BF	N	N	L-M	L-M	L	L	L-M	L-M	N	N
	CD	N	N	N	N	N	N	N	N	A	A
	DC	L	M-A	M	M	N	N	L-M	L-M	N	N
	DS	L	M	M	M	N	N	L-M	L-M	N	N
	HB	N	N	L	L	L-M	L-M	N	N	N	N
	PB	N	N	L-M	L-M	L	L	N	N	N	N
	RD	N	N	N	N	L	L	L	L	N	N
	RS	N	N	N	N	L-M	L-M	N	N	L	L
	WB	N	N	N	N	N	N	N	N	N	N
	WF	N	N	N	N	N	N	N	N	N	N
	WS	N	N	N	N	N	N	N	M	N	N

[1]C - after clearing; F - after fire.

[2]Abundance Ratings: N - none, L - low, M - moderate, A - abundant.

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